Faculdade de Ciências da Universidade de Lisboa

Departamento de Matemática

Instituto Universitário de Lisboa

# THE HALLOWEEN EFFECT IN EUROPEAN EQUITY MUTUAL FUNDS

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Master Dissertation in Mathematical Finance

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## Resumo

Bouman e Jacobsen (2002) documentaram a existência de uma anomalia sazonal nos retornos do mercado das acções, à qual chamaram efeito *Halloween*. Bouman e Jacobsen (2002) constataram que num considerável número de países os retornos durante os meses de Maio a Outubro tendem a ser bastante inferiores aos retornos registados durante os meses de Novembro a Abril.

Nesta dissertação seguimos de perto a metodologia usada por Bouman e Jacobsen (2002), com o objectivo de estudar o efeito *Halloween* nos Fundos de Acções Europeias, durante o período de 1997 a 2013. Ao longo desta dissertação registamos evidências da presença deste efeito no mercado dos Fundos de Acções Europeias, testamos se a anomalia persiste após a publicação de Bouman e Jacobsen em 2002 e mostramos que uma estratégia de investimentos baseada nesta anomalia sazonal consegue bater o mercado.

Concluímos que o efeito *Halloween* é estatisticamente e economicamente significante, e que a anomalia nos retornos dos mercados de acções dever-se-á aos retornos negativos durante o período de Maio a Outubro, e não aos elevados retornos registados durante o período de Novembro a Abril.

**Palavras-Chave:** Efeito *Halloween*, Eficiência de Mercado, Anomalia, Retornos.

**Classificação JEL:** G10, G14

## Abstract

Bouman and Jacobsen (2002) documented the existence of a calendar anomaly in stock market returns, which they call the Halloween effect. They found evidence that in a large number of countries returns during the months of May to October tend to be unusually lower that returns during the months of November to April.

In this dissertation we follow closely the methodology used by Bouman and Jacobsen (2002), to study the presence of the Halloween effect in European Equity Mutual Funds, from 1997 to 2013. We provide evidences of the presence of this effect in the European Equity Mutual Funds market, we test whether this effect has disappeared after the Bouman and Jacobsen publication in 2002 and we show that an investment strategy based on this anomaly can beat the market.

We conclude that the Halloween Effect is statistically and economically significant, and that this anomaly in the stock market returns might be due to the negative average returns during the months of May to October, rather than a higher performance during the period from November to April.

**Key Words:** Halloween Effect, Market Efficiency, Anomaly, Returns.

**JEL Classification code:** G10, G14

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# 1. Introduction

The Efficient Market Hypothesis has more than one century of history, it was first introduced by Bachelier in 1900 and later presented by Fama in 1970, and however no one knows the answer to the question: "Are Stock Markets Efficient?".

Recent studies present evidence that stock markets returns tend to be lowers, and even negative, from May to October and higher over the period November to April. This calendar anomaly was studied by Bouman and Jacobsen (2002) in their publication "Sell in May and go away" in which they refer to this anomaly as the "Halloween effect". They found evidence of the presence of this anomaly in 36 of the 37 countries in their sample. This seasonal pattern questions the Efficient Market Hypothesis mainly because this anomaly has been known for quite time and yet it seems to persist in the stock markets.

This dissertation examines the existence of the Halloween effect in the European Equity Mutual Funds based on a sample of 145 funds and data from 1997 to 2013. This study should contribute to the existing literature in several ways:

- The study focus on the European Equity Mutual Funds which is the first time that it happens, as long as we know the Halloween effect was not yet study in the Equity Mutual Funds markets of European countries.
- We show that the January effect is not the explanation for this anomaly.
- We document that the Halloween effect became statistically insignificant after Bouman and Jacobsen (2002) publication.

This dissertation has four main sections, in section 1 we present a review of the literature on the Halloween effect. In section 2 we present the data, methodology used and results. In section 3 we do some robustness checks and document the existence of the Halloween effect. Finally, section 4 summarizes the main conclusions on this dissertation.

A market is called efficient when the price trend completely reflects all the available information. Fama (1970) stated three conditions for the market efficiency: (i) there are no transaction costs in trading securities; (ii) all available information is costless available to all market participants; and (iii) all agree on the implications of current information for the current price and distributions of future prices of each security. Fama has also noted that these conditions are sufficient but not necessary for market efficiency.

In consequence of this, if markets are efficient, prices are not predictable and therefore it's not possible to consistently exceed average market returns on a risk-adjusted basis.

Fama (1970) proposed three forms of financial markets efficiency: (i) strong; (ii) semi-strong; and (iii) weak efficiency.

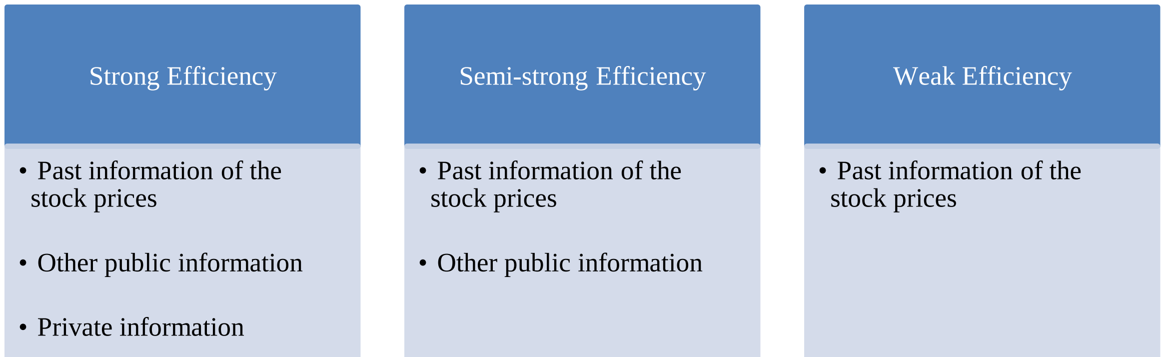


**Figure 1 - The three form of Market Efficiency proposed by Fama (1970)**

The weak form of efficiency states that an investor cannot predict and beat the market because the current price already reflects all the past information. The semi-strong form sets that technical analysis is useless to achieve higher profits because it assumes that the current price reflects all the public information available. Finally, the strong form of efficiency says that there is no way of an investor get higher than normal returns since the price already incorporates all the available information, public and private.

The Efficient Market Hypothesis (EMH) theory was initially accepted however, empirical studies made during the 90's have found some problems with this theory. A few patterns and seasonal effects, also called of anomalies, have been identified in the prices trend, such as the Monday effect, the January effect, the Holiday effect and the Halloween effect.

In the real world there are a few and some very obvious arguments against the Efficient Market Hypothesis, although, the Efficient Market Hypothesis doesn't dismiss the possibility of anomalies in the market that result in higher profits, however the investment strategies based on these patterns cannot be frequent and consistent over the time.

Nevertheless the question stills, can we assume that stock markets are efficient? If yes, then we can assume that investors will only be rewarded for the risk that they take, this means that there is no way for an investor to get higher profits without take higher risks.

Bouman and Jacobsen (2002) have contributed to this discussion with their paper *The Halloween Indicator: Sell in May and Go Away*. They tested whether there is some truth in the old market wisdom "Sell in May and go away", also known as "Halloween Indicator". Using monthly stock returns of 37 countries, they found that for 36 countries, mean returns for the period November-April are higher than for the period May-October. Moreover, returns during the period May-October are not significantly different from zero and are often even negative.

To analyze the evidence of the anomaly in their sample, they have included a simple dummy in the regression equations that takes the value 1 if the month falls on the period November-April and takes the value 0 otherwise. Bouman and Jacobsen (2002) analyze developed and emerging markets from 37 between January, 1970 through August, 1998 and found statistical evidence, at the 10 percent level, of a strong Sell in May effect in 20 stocks markets, they also found that the effect tends to be particularly strong and highly significant in European countries.

Bouman and Jacobsen (2002) study two investment strategies and argue that the Halloween strategy outperforms the Buy and Hold strategy on a risk-adjusted basis.

In addition, Bouman and Jacobsen (2002) show that the effect cannot be explained by factors such as the January effect, data mining, changes in interest rates and volume and the provision of news. They found that the relative strength of the effect in different countries is related to several proxies for the timing and length of summer vacations and that countries with a strong summer vacation tradition exhibit the most strongly effect.

Nobody knows exactly when was this effect first identified neither how old is this market wisdom. Levis (1985) mentioned the anomaly but he didn't test whether the anomaly truly exists. Later O'Higgins and Downs (1990) study the United States stock market and found evidence of an investment strategy, which they called Halloween strategy that can beat the stock market, this strategy is the same defined in the Bouman and Jacobsen (2002) study.

Kamstra, Kramer and Levi (2003) suggest a possible explanation for the Halloween Effect. They have documented a similar pattern in stock returns and explain it as a seasonal affective disorder[1] (SAD) effect in stock returns. They believe that the decreasing hours of daylight during fall makes investors depressed and that leads to higher risk aversion, stock returns are lower during the fall and then become relatively higher during the winter months when days start to extend (after the winter solstice).

Based on stock market index data from countries at various latitudes and on both sides of the equator line they found evidences that support the existence of an important effect of SAD on stock market returns around the world.

We do think that Kamstra, Kramer and Levi (2003) arguments are not consistent. If they think that the seasonal effect is related to the length of the day, then we expect returns during the spring and summer months, when days are longer, to be higher rather than in

[1] SAD is a medical condition whereby the shortness of days lead to depression for many people.

winter months. There are other authors that also suggest that the SAD explanation for the Halloween effect is not reliable.

First, Jacobsen and Marquering (2008), confirmed that there was a strong seasonal effect in stock markets returns for several countries where returns tend to be lower during the summer months than during the winter. They mentioned that the correlation between weather and stock returns would be just data-driven and therefore is not a potential explanation for the anomaly. Additionally they also suggested that the SAD argument is not a strong explanation for countries near to the equator line.

Second, Kelly and Meschke (2010), in a more psychological view mentioned that the SAD hypothesis is not supported by the psychological literature since the seasonal patterns for the SAD presented by Kamstra, Kramer and Levi (2003) don't match with the general patterns found in depression.

Finally, Carrazedo (2010, page 9), said that Kamstra, Kramer and Levi (2003) arguments do not seem consistent. Firs he argues that *"according to the medical evidence on the incidence of SAD, this seasonal is related to the length of the day and not to changes in the length of the day"*, furthermore, the author also said that "*they should have examined whether event-induced mood change actually affects investor perception of financial risk or return and whether such a change in perception manifests itself in trading behavior"*.

Maberly and Pierce (2004, page 43) analyzed the Halloween effect in the U.S. stock market, from April 1982 through April 2003, and contended that the anomaly that Bouman and Jacobsen (2002) identified in the U.S. equity returns appears to be due to the presence of two outliers in their sample: *"the large monthly declines for October 1987 and August 1998 associated with the stock market crash and collapse of the hedge fund Long-Term Capital Management, respectively"*. Furthermore they found that the effect disappears after the adjustment of the data.

Jacobsen *et al* (2005), say that "the Halloween Effect is a market wide phenomenon". They found that the Halloween Effect is not related to the January Effect neither with the portfolio value, earning price ratios and cash flow price ratios.

Reichling and Moskalenko (2008) analyzed whether a summer break is also present on the Russian stock market. They analyzed the RTS index from 1995 to 2006 and saw that the September-to-May strategy seems to perform best amongst stock investments with a duration of eight months, they identified the best month to exist the market as May, which supports the saying "Sell in May and go away", and saw that the entry time should be the end of September. Moreover they have seen that the advantage of this strategy is firstly due to the entry time in the market at the end of September and secondly because of the exit time in May.

The Halloween Effect was also studied by Doeswijk (2008) but on a global perspective with stock markets returns being measured by the MSCI World index and analyzed for the period 1970-2003. He found that returns from May through September tend to be negative or close to zero and that differences in average returns between November-April and May-October periods are about 7.5% in the range 1970-1986 and 7.7% for 1987-2003.

Doeswijk (2008) suggests that the anomaly could result from an optimist cycle, he says that investors think in calendar year, instead of twelve rolling months, and that in the beginning of the year they are too optimistic about the market growth and earnings, after the summer break investors become more pessimistic and during the last quarter of the year investors start looking forward to the next calendar year.

Lucey and Zhao (2008) study the Halloween effect in the US equity market and conclude that the Halloween effect presented by Bouman and Jacobsen (2002) may not exist, being no more than a reflection of the January effect. Contrary to the Bouman and Jacobsen (2002) results they saw that the Halloween strategy is not obviously more profitable than the buy-and-hold strategy.

Hong and Yu (2009) investigate the jointly seasonality in trading activity and assets prices during vacation periods. They argue that investors have “gone fishing” and that therefore the volume of trading assets is lower during the summer. In their sample of 51 stock markets, they found that returns are lower during July, August and September and that this effect is particularly strong in countries farther from the equator line. Moreover they saw that both small and large investors trade less and that the bid-ask spread is higher during summer months.

Jacobsen and Visaltanachoti (2009) in their study on U.S. equity sectors in the period 1926-2006, found that 48 of 49 industries perform better during the winter than during the summer. The authors define an investment strategy, labeled, sector rotating strategy, that consists in invest in production related sectors during the winter and expose their portfolio to consumer related sectors during the summer.

Jacobsen and Zhang (2010) analyze monthly return seasonality using 300 years of UK stock market data (the period 1693-2009) and conclude that the Halloween effect is robust over different subsample periods. They have examined in more detail whether summer returns are consistently lower than the risk free rate and come with a negative summer risk premium for 201 of the 317 years in their sample. Additionally they also show that trading rules based on the Halloween effect beat the market more than 80% of the time over 5 years horizons.

There is no consensus so far about the existence of the anomaly neither about the causes of this effect, if it really exists. The million dollar question stills: Can an investor get higher profits without take the higher risk?

# 2. The Puzzle

## 2.1 Data

In our analysis, we select 145 funds that invest in equities through European countries and with an amount of assets under management no less than 500 million Euros.

The main reason for the use of European funds is that the Halloween effect is barely known in European countries, when compared to American countries, and there are only a few studies about European Equities Mutual Funds.

To study the Halloween effect in European Equities Mutual Funds we start with monthly prices returns over the period 1997-2013. Table 1 shows some statistical information based on monthly logarithmic returns of the funds.

| | **Total** | **Size** | | | **Style** | | |
|---|---|---|---|---|---|---|---|
| | | **Small** | **Mid** | **Large** | **Growth** | **Blend** | **Value** |
| **Number of Funds** | 145 | 7 | 63 | 75 | 20 | 98 | 27 |
| **Average Returns** | 0.4% | 0.5% | 0.4% | 0.3% | 0.4% | 0.4% | 0.3% |
| **Standard Deviation** | 5.6% | 6.0% | 5.5% | 5.6% | 5.5% | 5.5% | 5.9% |
| **Median** | 0.9% | 1.2% | 0.7% | 1.0% | 1.1% | 0.8% | 1.0% |
| **Minimum** | -183.9% | -25.0% | -61.3% | -183.9% | -25.0% | -183.9% | -25.1% |
| **Maximum** | 71.8% | 27.0% | 71.8% | 31.7% | 27.0% | 71.8% | 29.8% |

**Table 1 – Statistical Summary of monthly returns.**
Table 1 reports statistics figures based on monthly returns of the funds: average, standard deviation, median, minimum and maximum returns. Statistical information is reported for small, mid and large cap funds and for growth, blend and value strategy funds.

From the analysis of our sample, we easily see that differences between the summer and winter returns are generally large. In most of the funds, returns over the summer tend to be negative or close to zero as Figure 2 suggests.

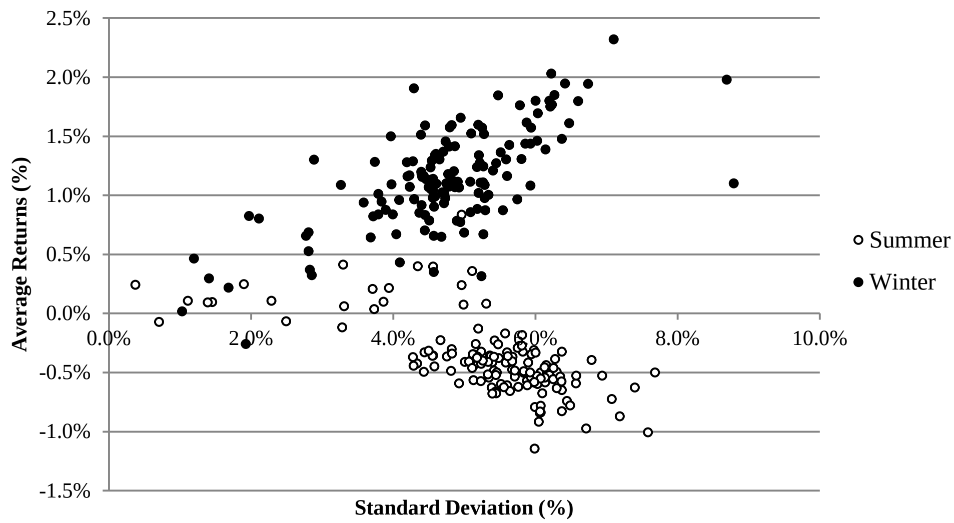


**Figure 2 – Funds Average Return and Risk.**
Figure 2 reports the average returns for each fund in the vertical axis and the standard deviation in the horizontal axis. Data presented in this figure is over the period 1997-2013.

In order to guarantee that the higher performance of the winter months is not related to a more risky period, we have also analyzed the standard deviation which, as figure 2 shows, is similar for both periods.

For 139 funds, average returns in the winter are higher than during the summer. If in one hand, average winter returns are positive for 140 of the 145 funds, in the other hand, summer returns are positive for only 19 of the 145 funds.

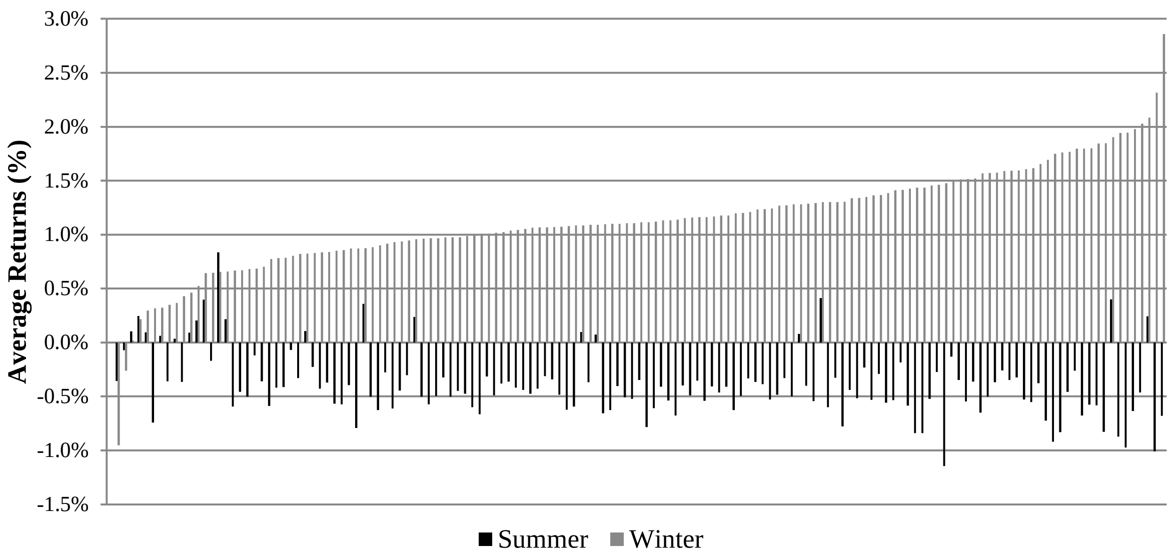


**Figure 3 – Funds Average Return by period (summer and winter)**
Figure 3 reports the average returns for each of the 145 funds during the summer (May-October) and the winter (November-April). Data presented in this figure is over the period 1997-2013.

It is important to notice that average returns during the winter are positive for each of the months in that period. Against our expectations, returns are not especially high in January but in December and April. Still, returns during summer months are lower and particularly bad in August and September.

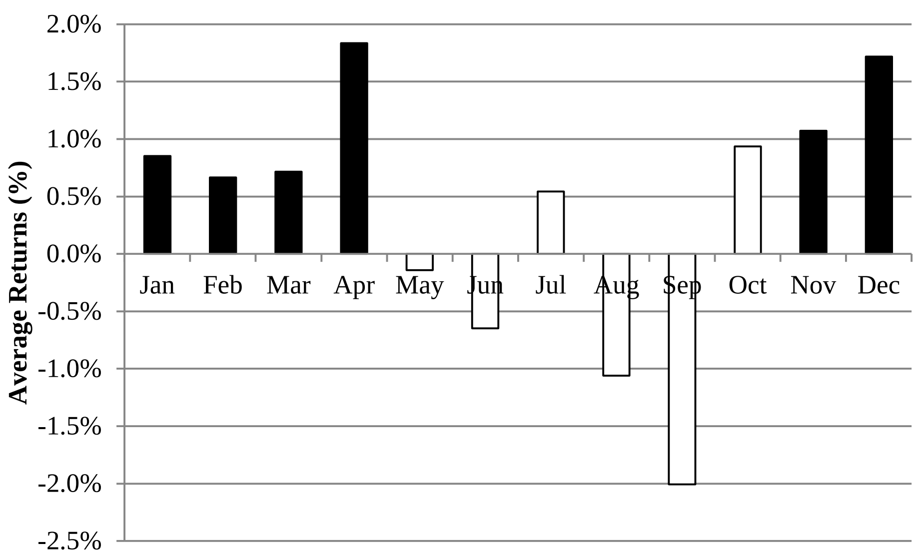


**Figure 4 – Average Returns by month**
Figure 4 reports the average returns for each month. Columns in blue are related to months in the summer and red columns are from months in the winter.

## 2.2 Methodology

The performance of the funds in this study was measured through monthly logarithmic returns defined as

$$r_t = ln\left(\frac{P_t}{P_{t-1}}\right) \tag{1}$$

Where $P_t$ is the close price of the fund at the last trading day of the month $t$ and $P_{t-1}$ is the close price of the fund at the last trading day of the previous month. By using this methodology to calculate the performance of each fund we are assuming continuously-compounded returns.

To test for the existence of a Halloween effect, and to be consistent with the Bouman and Jacobsen (2002) approach, we use the following regression equation:

$$\boldsymbol{r_t = \alpha + \beta D_H + \varepsilon_t} \tag{2}$$

Where $D_H$ is a dummy variable, $\alpha$ and $\beta$ are parameters, $r_t$ is the continuously compounded return and $\varepsilon_t = r_t - E_{t-1}(r_t)$ with $\varepsilon_t \sim N(0, \sigma_\varepsilon^2)$.

The variable $D_H$ is the Halloween dummy that equals 1 if the month $t$ falls in the period November through April and takes the value 0 in the period May through October. Thus the constant $\alpha$ represents the average return for the period May-October, when the variable $D_H$ takes the value 0, and the coefficient estimate $\beta$ represents the difference between the average returns for the two periods November-April and May-October. If a Halloween effect is present we expect the coefficient $\beta$ to be significantly different from zero.

To estimate the parameters $\alpha$ and $\beta$, we use the Ordinary Least Squares method (OLS). $\varepsilon_t$ is the usual error term. In order to deal with errors we apply the OLS coefficients standard error corrections. White (1980) procedures are applied in presence of heteroscedasticity and Newey-West (1987) procedures when in presence of both heteroscedasticity and autocorrelation or only autocorrelation.

## 2.3 Results

From the analysis made in section 2.1, we observed that returns for these two periods are generally large but the relevant question is whether this difference is also statistical significant.

In Table A1 we report some statistics and basic estimations from equation (2) for each fund; funds are sorted from the smallest to the largest *p-value*.

Table 2 reports the results for the annualized average returns, annualized standard deviation and general conclusions from the seasonality test specified by the regression in (2).

| Statistical significance of the Halloween Effect<br>$R_t = \alpha + \beta D_h + \varepsilon_t$<br>(Bouman & Jacobsen, 2002) | | |
|---|---|---|
| $\alpha$ ($\sigma_\alpha$) | -0.0465 | (0.0106) |
| $\beta$ ($\sigma_\beta$) | 0.2030 | (0.0228) |
| Number of funds | | |
| Reject $\alpha$=0 level of 10% | 1+ 1- | |
| Reject $\alpha$=0 level of 5% | 0+ 0- | |
| Reject $\alpha$=0 level of 1% | 0+ 0- | |
| Funds with $\alpha$>0 | 19 | |
| Number of funds | | |
| Reject $\beta$=0 level of 10% | 120+ 0- | |
| Reject $\beta$=0 level of 5% | 101+ 0- | |
| Reject $\beta$=0 level of 1% | 26+ 0- | |
| Funds with $\beta$>0 | 140 | |
| Funds with $\beta$>$\alpha$ | 139 | |

**Table 2 – Halloween Effect statistical significance.**
Table 2 shows the average of the estimated parameters $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ as well as the average standard deviation for the regression (rows 1 and 2), this figures are annualized; The number of funds to which each parameter was rejected for the 1, 5 and 10 percent levels is split by number of funds with a positive value (+) and number of funds with a negative value (-) for the estimation of the parameter $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$.

There is a significant Halloween effect present in 120 of the 145 funds in our sample, at the 10 percent level, and in 101 funds at the 5 percent level. Moreover, we have also seen that in 139 funds the return during the winter is greater than the return during the summer and only at the 10 percent level is possible to identify a fund with a positive and significant summer return.

As presented in section 2.1, returns tend to be below average in all summer months, being especially lower in August and September, while during the winter months returns lean to be positive and high.

We have just tested whether mean returns during the winter are higher than during the summer, an interest point to analyze is whether the difference between these periods is due to the performance of specific months instead of the performance of the whole period.

The January effect is the anomaly of the stock prices to rise between 31st December and the end of the first week of January. For that reason, the higher returns during the winter months could be merely the January effect. In order to discard that possibility, we test whether the Halloween effect is in fact the January effect. To do so, we consider an additional dummy variable in equation (2), $D_{Jan}$, which takes the value 1 in January and 0 otherwise. The dummy variable for the Halloween effect, denoted by $D_{adj}$, is now adjusted so that it takes the value 1 in the period November to April, except in January, and 0 in May to October:

$$r_t = \alpha + \beta_1 D_{adj} + \beta_2 D_{Jan} + \varepsilon_t \tag{3}$$

The Statistical significance results are once again summarized below:

| Statistical significance of the HE with the January Effect<br>$R_t = \alpha + \beta_1 D_{adj} + \beta_2 D_{Jan} + \varepsilon_t$<br>(Bouman & Jacobsen, 2002) | | |
|---|---|---|
| $\alpha$ ($\sigma_\alpha$) | -0.0465 | (0.0106) |
| $\beta_1$ ($\sigma_{\beta 1}$) | 0.2114 | (0.0220) |
| $\beta_2$ ($\sigma_{\beta 2}$) | 0.1618 | (0.0676) |
| Number of funds | | |
| Reject $\alpha$=0 level of 10% | 1+ 1- | |
| Reject $\alpha$=0 level of 5% | 0+ 0- | |
| Reject $\alpha$=0 level of 1% | 0+ 0- | |
| Funds with $\alpha$>0 | 19 | |
| Number of funds | | |
| Reject $\beta_1$=0 level of 10% | 119+ 0- | |
| Reject $\beta_1$=0 level of 5% | 106+ 0- | |
| Reject $\beta_1$=0 level of 1% | 25+ 0- | |
| Funds with $\beta_1$>0 | 140 | |
| Number of funds | | |
| Reject $\beta_2$=0 level of 10% | 29+ 1- | |
| Reject $\beta_2$=0 level of 5% | 20+ 1- | |
| Reject $\beta_2$=0 level of 1% | 5+ 1- | |
| Funds with $\beta_2$>0 | 133 | |
| Funds with $\beta_1$>$\alpha$ | 138 | |
| Funds with $\beta_2$>$\alpha$ | 139 | |

**Table 3 - Halloween Effect statistical significance controlled for the January effect.**
Table 3 shows the average of the estimated parameters $\boldsymbol{\alpha}$, $\boldsymbol{\beta_1}$ and $\boldsymbol{\beta_2}$ as well as the average standard deviation for the regression (rows 1-3), both statistics figures are annualized; The number of funds to which each parameter was rejected for the 1, 5 and 10 percent levels is split by number of funds with a positive value (+) and number of funds with a negative value (-) for the estimation of the parameter $\boldsymbol{\alpha}$, $\boldsymbol{\beta_1}$ and $\boldsymbol{\beta_2}$.

We found that the Halloween Effect is still present in most of the funds, 119 of the 120 funds where we previously found a significant Halloween Effect. The January Effect is only significant and positive for 29 funds.

Therefore we reject the hypothesis that the Halloween Effect is explained by the January Effect. Moreover, we can generally say that the January Effect is not present in our sample. Although from our analysis in section 2.1 we saw that returns seem to be different in different months, thus we need to see whether this difference is statistical significant. The parametric test examines the joint significance of all the twelve months through the following equation:

$$r_t = \alpha_1 + \alpha_2 D_{2t} + \alpha_3 D_{3t} + \dots + \alpha_{12} D_{12t} + \varepsilon_t \tag{4}$$

As usual, $r_t$ is the continuously compounded return and $\varepsilon_t = r_t - E_{t-1}(r_t)$. $D_{it}$ is the dummy variable that takes the value 1 for month *i* and 0 otherwise, $\alpha_1$ is the average return for January and $\alpha_i$ is the coefficient estimate for month *i* that represents the difference between the January returns and the returns in other months.

If returns for each month are similar we expect that $\alpha_i$, where *i* goes from 2 to 12, are jointly insignificant which means that in the global test to the model, we will not reject the hypothesis $H_0$:

$$H_0: \alpha_2 = \alpha_3 = \cdots = \alpha_{11} = \alpha_{12} = 0$$

Similar to what Jacobsen and Zhang (2010) saw in their publication, our analysis indicates that there are significant differences between months for some funds. However this test does not clarify which months contribute to this seasonality, to do so we will test for each individual month the following regression:

$$r_t = \alpha + \beta D_{it} + \varepsilon_t \tag{5}$$

Where $D_i$ is the dummy variable that takes the value 1 if *t* falls in the month *i*, and takes the value 0 otherwise. $\beta$ is the average return for month *i* and $\alpha$ represents the difference between the month *i* returns and the returns in other months.

| | $\beta$ | $\sigma_\beta$ | Reject $\beta$=0 at the 10% level | | Reject $\beta$=0 at the 5% level | |
|---|---|---|---|---|---|---|
| | | | $\beta>0$ | $\beta<0$ | $\beta>0$ | $\beta<0$ |
| January | 0.52% | 1.93% | 11 | 2 | 7 | 1 |
| February | 0.32% | 0.82% | 0 | 2 | 0 | 1 |
| March | 0.37% | 0.57% | 1 | 1 | 0 | 1 |
| April | **1.59%** | 0.82% | **24** | 0 | 4 | 0 |
| May | -0.56% | 0.52% | 0 | 0 | 0 | 0 |
| June | -1.12% | 0.66% | 0 | 3 | 0 | 2 |
| July | 0.19% | 0.59% | 1 | 0 | 0 | 0 |
| August | -1.57% | 0.79% | 0 | **24** | 0 | **3** |
| September | **-2.60%** | 1.05% | **0** | **108** | 0 | **82** |
| October | 0.61% | 0.76% | 3 | 0 | 1 | 0 |
| November | 0.76% | 0.87% | 1 | 1 | 0 | 1 |
| December | 1.47% | 0.75% | 6 | 2 | 1 | 1 |

**Table 4 - Statistical significance of each month.**
Table 4 shows the average of the estimated parameter $\boldsymbol{\beta}$ as well as the average standard deviation (columns 2-3) for each month as well as the number of funds to which we reject the hypothesis that $\boldsymbol{\beta}$ is 0 at the 10% and 5% levels, split by the signal of $\boldsymbol{\beta}$.

We now see that September returns are responsible for bad performances in average returns for 108 funds, at the 10 percent level, and 82 funds if we require a 5 percent level.

As Figure 4 has predicted, the lowest monthly returns are in September, however, we were also expecting April to be a significant month in average returns, which happens but only for 24 funds at the 10 percent level and that number falls to 4 if we require a 5 percent level.

# 3. Robustness Checks

In this section we will test if the Halloween Effect is correctly identified. For that purpose we will first analyze whether the Halloween Effect is equally present in funds with different sizes and investment strategies. We will then test whether the anomaly is still significant when we use daily returns instead of monthly figures. Hereafter we study if the Halloween Effect is no more than a good performance on the last quarter of the year, October through December, or on the other hand it is due to a poor performance on the third quarter, July through September.

Finally it is important to test whether the anomaly is still present in the European Mutual Funds market after the Bouman and Jacobsen publication in 2002, otherwise conclusions from this study could be wrongly assigned to the period from 1997 through 2013 if the affect disappears after 2002.

On the last section we compare the performance of two investment strategies, one based on the known Buy-and-Hold principal and the other one called Halloween strategy, which is no more than investing in European Mutual Funds during the winter and invest in a risk-free asset during the summer.

## 3.1 Size and Style Effects

The first point that we will see is if the Halloween Effect is present in all type of funds, regardless the fund size or investment style.

We then split the funds in our sample by size: small, mid or large cap; and by investment style: value, blend or growth. In order to get some conclusions we exclude the blend funds from this analysis.

| Statistical significance of the Halloween Effect<br>$R_t = \alpha + \beta D_h + \varepsilon_t$<br>(Bouman & Jacobsen, 2002) | | | | | |
|---|---|---|---|---|---|
| Panel A - Halloween Effect statistical significance for Small Cap Funds. | | | Panel B - Halloween Effect statistical significance for Large Cap Funds. | | |
| α | -0.0501 | | α | -0.0710 | |
| β | 0.1899 | | β | 0.3183 | |
| Number of funds | | 75 | Number of funds | | 7 |
| Reject α=0 level of 10% | | 1+ 1- | Reject α=0 level of 10% | | 0+ 0- |
| Reject α=0 level of 5% | | 0+ 0- | Reject α=0 level of 5% | | 0+ 0- |
| Reject α=0 level of 1% | | 0+ 0- | Reject α=0 level of 1% | | 0+ 0- |
| Funds with α>0 | | 4 | Funds with α>0 | | 0 |
| Number of funds | | 75 | Number of funds | | 7 |
| Reject β=0 level of 10% | | 63+ 0- | Reject β=0 level of 10% | | 7+ 0- |
| Reject β=0 level of 5% | | 49+ 0- | Reject β=0 level of 5% | | 7+ 0- |
| Reject β=0 level of 1% | | 6+ 0- | Reject β=0 level of 1% | | 5+ 0- |
| Funds with β>0 | | 73 | Funds with β>0 | | 7 |
| Funds with β>α | | 73 | Funds with β>α | | 7 |

**Table 5 – Halloween Effect and the Size Effect.**
Tables 5 shows the average of the estimated parameters $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ as well as the average standard deviation for the regression (rows 1 and 2), both figures are annualized; The number of funds to which each parameter was rejected for the 1, 5 and 10 percent levels is split by number of funds with a positive value (+) and number of funds with a negative value (-) for the estimation of the parameter $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$.

Panel A and B present a summary of the results for small cap and large cap funds in our data base. The Halloween Effect appears to be present in all the small cap funds at 10 and 5 percent level and at the 1 percent level it keeps present in 5 of the 7 funds. On the opposite side of the small caps are the large cap funds, at the 5 percent level the Halloween Effect is present in 49 of the 75 large cap funds. It's important to notice that returns for 73 large cap funds are higher during the winter than during the summer and that returns during the summer are only positive (but not significant at 5 percent level) for 4 funds.

Statistical significance of the Halloween Effect

$$R_t = \alpha + \beta D_h + \varepsilon_t$$

(Bouman & Jacobsen, 2002)

| Panel A - Halloween Effect statistical significance for Value Style Funds. | | Panel B - Halloween Effect statistical significance for Growth Style Funds. | |
|---|---|---|---|
| α | -0.0530 | α | -0.0598 |
| β | 0.2073 | β | 0.2524 |
| Number of funds | 27 | Number of funds | 20 |
| Reject α=0 level of 10% | 0+ 0- | Reject α=0 level of 10% | 0+ 0- |
| Reject α=0 level of 5% | 0+ 0- | Reject α=0 level of 5% | 0+ 0- |
| Reject α=0 level of 1% | 0+ 0- | Reject α=0 level of 1% | 0+ 0- |
| Funds with α>0 | 1 | Funds with α>0 | 1 |
| Number of funds | 27 | Number of funds | 20 |
| Reject β=0 level of 10% | 21+ 0- | Reject β=0 level of 10% | 20+ 0- |
| Reject β=0 level of 5% | 17+ 0- | Reject β=0 level of 5% | 18+ 0- |
| Reject β=0 level of 1% | 3+ 0- | Reject β=0 level of 1% | 7+ 0- |
| Funds with β>0 | 27 | Funds with β>0 | 20 |
| Funds with β>α | 27 | Funds with β>α | 20 |

**Table 6 – Halloween Effect and the Style Investment.**
Tables 6 shows the average of the estimated parameters $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ as well as the average standard deviation for the regression (rows 1 and 2), both figures are annualized; The number of funds to which each parameter was rejected for the 1, 5 and 10 percent levels is split by number of funds with a positive value (+) and number of funds with a negative value (-) for the estimation of the parameter $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$.

Table 6 shows a similar summary of the analysis but this time for the value and growth strategy funds. For both strategies, all the returns are higher during the winter than during the summer and summer returns are positive (but not significant) for only one fund in each group. The Halloween anomaly is present in all the growth strategy funds, at the 10 percent level, and it keeps present in 90% of the growth funds at the 5 percent level.

From this analysis we conclude that the Halloween Effect appears to be equally present in small cap and large cap funds and in value style and growth style funds. Although it is important to notice that due to the small number of funds in each group we cannot generalize this conclusions.

## 3.2 Daily Frequency

An important point to study is whether we still find a significant Halloween Effect if we use daily prices instead of monthly prices. We then repeat the test using regression equation (2)

| | | Daily Returns | | Monthly Returns | |
|---|---|---|---|---|---|
| α | | -0.0022 | | -0.0465 | |
| β | | 0.0086 | | 0.2030 | |
| Reject α=0 | level of 10% | 2+ | 4- | 1+ | 1- |
| | level of 5% | 1+ | 0- | 0+ | 0- |
| | level of 1% | 0+ | 0- | 0+ | 0- |
| Reject β=0 | level of 10% | 106+ | 0- | 120+ | 0- |
| | level of 5% | 61+ | 0- | 101+ | 0- |
| | level of 1% | 26+ | 0- | 26+ | 0- |
| Funds with β>α | | 139 | | 139 | |

**Table 7 - Halloween Effect statistical significance for daily and monthly returns.**
Table 7 shows the average of the estimated parameters $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ for the regression (rows 1 and 2) for daily returns (column 1) and for monthly returns (column 2), figures are annualized; The number of funds to which each parameter was rejected for the 1, 5 and 10 percent levels is split in number of funds with a positive value (+) and number of funds with a negative value (-)for the estimation of the parameter $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$.

Results for daily prices are slightly different from those presented in Table 1, also shown in Table 7, the average estimation of $\alpha$ and $\beta$ are now closer to 0, but we still have a negative value for the average $\alpha$ and a positive value for the average $\beta$. Regarding the presence of the Halloween Effect, we see that it is now significant at the 10 percent level for 106 funds, less 14 funds than before, although at the 5 percent level we “lose” 40 funds with the change on data frequency.

## 3.3 Recovery of the Performance

Doeswijk (2009) argue that is on the last months of the year that funds managers try to beat the benchmark in order to close the year with greater results. The monthly analysis, on section 3.1, give us the clue that returns on last quarter of the year are generally high. An interesting analysis would be to see whether these three months are indeed responsible for the winter performance. To test that we will follow the usual approach and define a new equation similar to equation (2):

$$r_t = \alpha + \beta D_{Q4} + \varepsilon_t \qquad (6)$$

As usual, $r_t$ is the continuously compounded return and $\varepsilon_t = r_t - E_{t-1}(r_t)$. $D_{Q4}$ is the dummy variable that takes the value 1 for October, November and December and 0 otherwise, $\beta$ is the coefficient estimate that represents the difference between the average returns and the returns in the fourth quarter.

| Statistical significance of the performance in Q4<br>$R_t = \alpha + \beta D_{Q4} + \varepsilon_t$ | | |
|---|---|---|
| $\alpha$ ($\sigma_\alpha$) | 0.0102 | (0.0118) |
| $\beta$ ($\sigma_\beta$) | 0.1490 | (0.0246) |
| Number of funds | | |
| Reject $\alpha$=0 level of 10% | 10+ 0- | |
| Reject $\alpha$=0 level of 5% | 9+ 0- | |
| Reject $\alpha$=0 level of 1% | 4+ 0- | |
| Funds with $\alpha$>0 | 80 | |
| Number of funds | | |
| Reject $\beta$=0 level of 10% | 62+ 1- | |
| Reject $\beta$=0 level of 5% | 23+ 1- | |
| Reject $\beta$=0 level of 1% | 1+ 1- | |
| Funds with $\beta$>0 | 133 | |
| Funds with $\beta$>$\alpha$ | 127 | |

**Table 8 - Fourth quarter performance in the overall performance.**
Table 8 shows the average of the estimated parameters $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ as well as the average standard deviation for the regression (rows 1-2), figures are annualized; The number of funds to which each parameter was rejected for the 1, 5 and 10 percent levels is split by number of funds with a positive value (+) and number of funds with a negative value (-) for the estimation of the parameter $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ .

We see that the fourth quarter performance is significant and positive for about 42% of the funds at the 10 percent level, however that value falls to only 17% if we require a 5 percent level. It seems that the hypothesis that the fourth quarter performance is responsible for the higher winter returns is not reliable.

Based on the analysis in section 2.1 we can also test whether lowers summer returns are due to the performance in the third quarter. We then repeat the previous test but now for Q3 instead of Q4.

| Statistical significance of the performance in Q3<br>$R_t = \alpha + \beta D_{Q3} + \varepsilon_t$ | | |
|---|---|---|
| $\alpha$ ($\sigma_\alpha$) | 0.0979 | (0.0111) |
| $\beta$ ($\sigma_\beta$) | -0.1767 | (0.0253) |
| Number of funds | | |
| Reject $\alpha$=0 level of 10% | 97+ 0- | |
| Reject $\alpha$=0 level of 5% | 61+ 0- | |
| Reject $\alpha$=0 level of 1% | 12+ 0- | |
| Funds with $\alpha$>0 | 143 | |
| Number of funds | | |
| Reject $\beta$=0 level of 10% | 1+ 114- | |
| Reject $\beta$=0 level of 5% | 0+ 88- | |
| Reject $\beta$=0 level of 1% | 0+ 9- | |
| Funds with $\beta$>0 | 7 | |
| Funds with $\beta$<$\alpha$ | 139 | |

**Table 9 - Third quarter performance in the overall performance.**
Table 9 shows the average of the estimated parameters $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ as well as the average standard deviation for the regression (rows 1-2), figures are annualized; The number of funds to which each parameter was rejected for the 1, 5 and 10 percent levels is split by number of funds with a positive value (+) and number of funds with a negative value (-) for the estimation of the parameter $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ .

We now see that returns in the third quarter are responsible for the poor performance of about 79% of the funds, and for about 96% of the funds returns in Q3 are lower than during the remaining period of the year.

## 3.4 Halloween Effect after Bouman and Jacobsen (2002) publication

The Halloween Effect has received a lot of mediatism after the publication of the paper in 2002, since it was the first time that the anomaly was deeply studied. According to the Murphy Law, after an anomaly is discovered it should disappear or reverse itself.

To study if the anomaly has disappeared or reversed itself after the study publication, we split the period of our analysis 1997-2013 in the following sub periods; 1997-2002, before the publication of the study in December 2002; 2003-2007 after the publication of the study and before the crisis; and 2008-2013 after the publication of the study and during the crisis. Before move to the regression analysis, we study the difference between winter and summer returns in those three periods stated above.

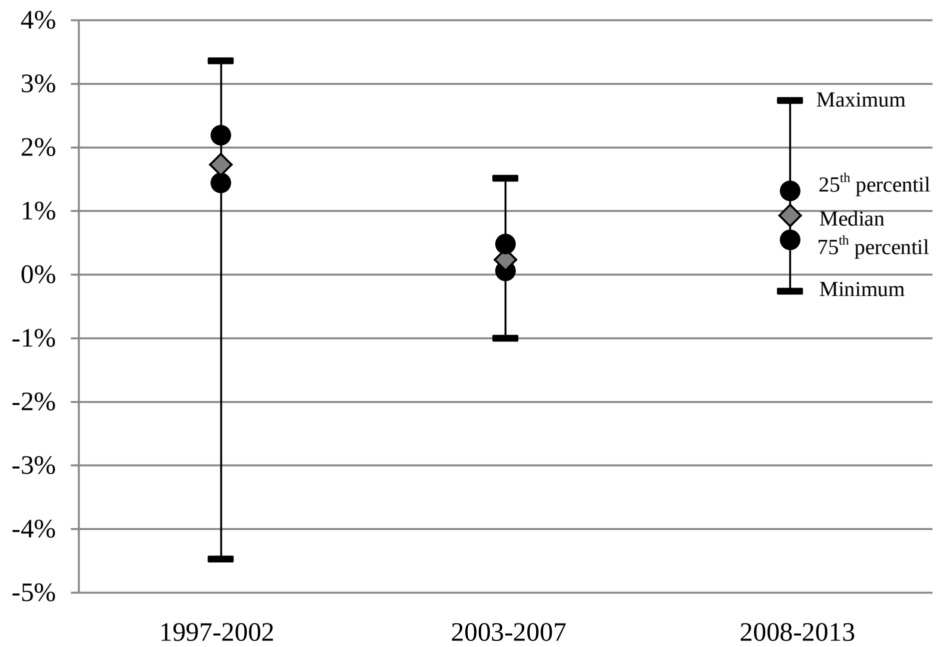


**Figure 5 – Differences between the winter and summer returns.**
Figure 5 shows the box plot of the differences between the winter and summer returns for the 145 funds. We present the minimum, 25th percentile, median, 75th percentile and maximum of the differences for the three periods: 1997-2002, 2003-2007 and 2008-2013.

While before the Bouman and Jacobsen publication, in 2002, winter returns were slightly different than summer returns, it looks like after 2002 those differences disappear and winter returns are now similar to summer returns. In figure 6 we can see that in the period 1997-2002 the 75th percentile was about 2.2%, after the Bouman and Jacobsen publication and before the 2008 crisis it falls to 0.5% but during the crisis it raises to 1.3%.

In order to check whether our suspicions are correct, we now use the usual regression defined in equation (2) for the periods 1997-2002, 2003-2007 and 2008-2013. Table 10 summarizes the statistical results:

| | | 1997-2002 | 2003-2007 | 2008-2013 |
|---|---|---|---|---|
| α | | -0.0076 | 0.0050 | -0.0516 |
| β | | 0.0189 | 0.0032 | 0.0715 |
| Reject α=0 | level of 10% | 3+ 32- | 25+ 0- | 1+ 0- |
| | level of 5% | 2+ 14- | 15+ 0- | 1+ 0- |
| | level of 1% | 2+ 5- | 6+ 0- | 1+ 0- |
| Reject β=0 | level of 10% | 128+ 0- | 10+ 0- | 0+ 0- |
| | level of 5% | 119+ 0- | 9+ 0- | 0+ 0- |
| | level of 1% | 47+ 0- | 4+ 0- | 0+ 0- |
| Funds with β>α | | 140 | 27 | 135 |

**Table 10 - Halloween Effect before and after the Bouman and Jacobsen (2002) study.**
Table 10 shows the average of the estimated parameters $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ for the regression (rows 1 and 2) for the period 1997-2002 (column 1), 2003-2007 (column 2) and for 2008-2013 (column 3); The number of funds to which each parameter was rejected for the 1, 5 and 10 percent levels is split in number of funds with a positive value (+) and number of funds with a negative value (-) for the estimation of the parameter $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$.

Over 1997-2002 at 5 percent level, we found the Halloween Effect present in 128 funds, although over 2003-2007 that anomaly is present in only 10 funds and seems to disappear after 2008. Moreover, in the period 1997-2002, $\alpha$ is significant and negative for 32 funds, at the 10 percent level but that significance disappears after the Bouman and Jacobsen (2002) publication. These results tell us that summer risk premia might not be negative after the publication and summer returns are now much closer to winter returns, as we have seen before. Therefore the Halloween Effect became statistically insignificant after Bouman and Jacobsen publication in 2002, although we cannot say that it is no longer economically significant as suggested in Figure 6.

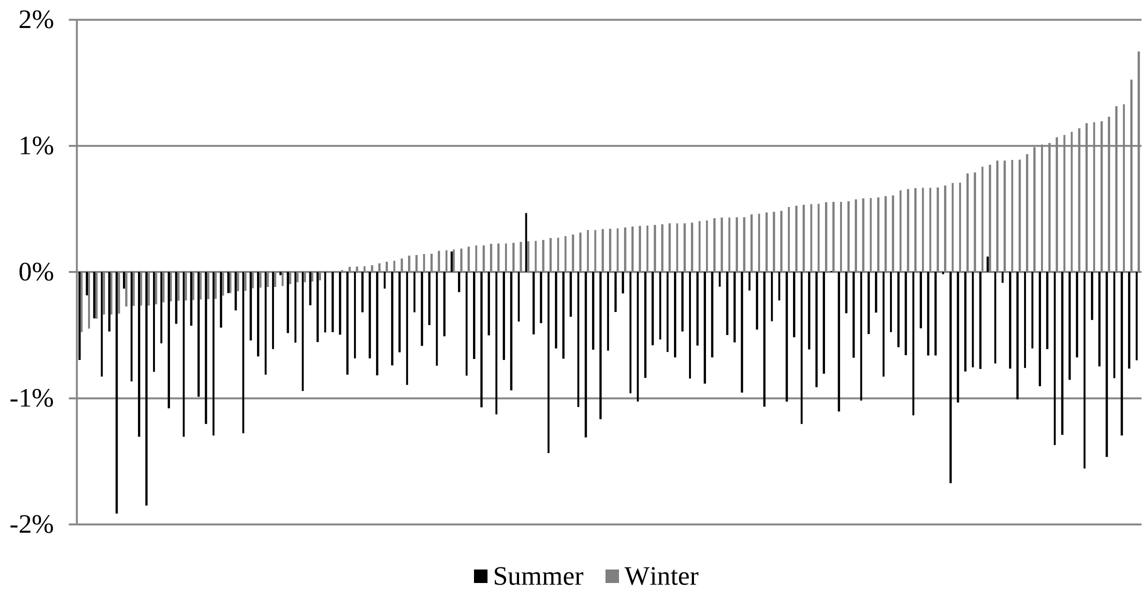


**Figure 6 - Funds Average Return in summer and winter over 2008-2013.**
Figure 6 reports the average returns for each of the 145 funds during the summer (May-October) and the winter (November-April). Data presented in this figure is over the period 2008-2013.

We now see that summer average returns are in general positive but lower than winter average returns, if we look in more detail we will see that monthly returns before and after 2002 are slightly different.

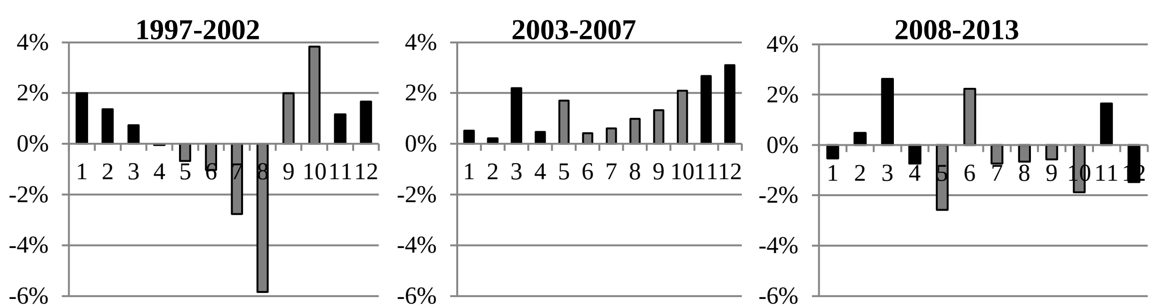


**Figure 7 - Average Returns before and after the Bouman and Jacobsen publication.**
Figure 7 reports the average returns for each month, in different periods: 1997-2002, 2003-2007 and 2008-2013. Columns in gray are referring to summer months (May to October) and columns in black are referring to winter months (November to April).

If in the period before the Bouman and Jacobsen publication we can clearly identify the presence of the Halloween effect, after 2002 and before the crisis, average monthly returns are always positive. During the crisis, after 2007, we see some differences in monthly returns but we cannot identify any pattern.

## 3.5 Trading Strategies

An interesting point to be study is to see how a trading strategy based on the Halloween Effect would perform in comparison to a simple buy and hold strategy. Many economists argue that is not possible to realize profits using anomalies like the Halloween Effect and that it only exists in the academic world.

For the purpose of study the strategy based on the Halloween anomaly, we then define two investment strategies: the Buy-and-Hold strategy and the Halloween strategy. In the Buy-and-Hold strategy we assume that the investor holds the portfolio over all the period. In the Halloween strategy we assume that the investor buys a portfolio at the end of October and sells that portfolio at the end of April, the investor will then invest in a risk free asset from the end of April through the end of October.

The risk free rate used in the study corresponds to the continuously-compounded Interbank Rate. We have used the Libor ECU 6 months from October 1997 to December 1998 and the Euribor 6 months from January 1999 to October 2013.

The results from our analysis are presented in detail in Table A2 of the Appendix: annualized returns, standard deviation and reward-to-risk ratio for both strategies. Table 11 reports the percentage of funds in which the Halloween strategy beats the Buy-and-Hold strategy regarding two points: return, percentage of funds in which the Halloween strategy outperformed the Buy-and-Hold strategy; reward-to-risk ratio, percentage of funds in which the reward-to-risk ratio of the Halloween strategy was bigger than the reward-to-risk ratio of the Buy-and-Hold strategy.

| % of funds in which the Halloween strategy beats the Buy-and-Hold strategy | | | | |
|---|---|---|---|---|
| | 1997-2013 | 1997-2002 | 2003-2007 | 2008-2013 |
| Return | 99% | 99% | 7% | 99% |
| Reward-to-Risk ratio | 93% | 97% | 99% | 99% |

**Table 11 – Halloween Strategy versus Buy-and-Hold Strategy.**
Table 11 shows the percentage of funds in which the Halloween strategy bets the Buy-and-Hold strategy, for the Return and for the Reward-to-Risk ratio and split by period. For example, this table reports that in the period 1997-2002, the Halloween strategy has outperformed the Buy-and-Hold strategy in 99% of the funds in our sample.

During the period 1997-2013, in about 99% of the funds the Halloween strategy outperforms the Buy-and-Hold strategy. This contradicts the financial principals saying that investors can get higher returns if and only if they take higher levels of risk.

After the analysis in section 3.4 where we have seen that over the period 2003-2007 average monthly returns are always positive, we were not expecting the Halloween strategy to beat the Buy-and-Hold strategy, this only happens in 7% of the funds.


**Figure 8 – Cumulative wealth for the two investment strategies.**
Figure 8 reports the cumulative wealth for the Buy-and-Hold strategy (discontinued line) and for the Halloween strategy (continued line), assuming that investors holds equal weights of all the funds in the sample.

Our results are similar to the Bouman and Jacobsen (2002), they saw that the Halloween strategy beats the Buy-and-Hold strategy for about 90% of the countries in their study.

The Halloween strategy seems to be an alternative way to face this market anomaly at least it was before the Bouman and Jacobsen (2002) publication. According to our analysis in only 56% of the funds the Halloween strategy beats the Buy-and-Hold strategy for the period after the Bouman and Jacobsen (2002) publication, 2003-2013.

As we show in section 3.4, lowers summer returns identified in the beginning of the study are no longer negative after 2002 and in some cases they are even greater than winter returns. Therefore it looks obvious that after 2002, summer risk premia became positive for most of the funds and the Halloween strategy cannot beat the Buy-and-Hold strategy anymore, at least is not "certainly".

While at the first stage we thought that the Halloween strategy was an opportunity to skip the lower returns from the Halloween Effect, we now think that it's not clear that this strategy is still an exploitable opportunity after 2002.

## 4. Conclusion

The "Sell in May and go away" is an old wisdom that refers that during months from November to April (winter) returns are larger than during the months from May to October (summer). This dissertation studied this market anomaly, so-called Halloween effect, in European Equity Mutual Funds following the Bouman and Jacobsen (2002) publication.

We use monthly logarithmic returns of 145 Equity Mutual Funds with an investment focus in Europe and from different sizes and following different investment strategies. Data in our sample covers the period from 1997 to 2013.

Our first interesting conclusion was that the Halloween effect economically significant in 139 of the 145 funds in our sample. Second, another relevant point is that mutual funds returns during the six-month period from May thought October are, on average, close to zero or even negative, on the other hand winter returns are unusually large. This anomaly goes against the Efficient Market Hypothesis, market returns shouldn't be predictably negative.

Third, we conclude that the Halloween effect is statistically significant, at the 10 percent level, for 120 of the 145 funds in our sample, this means that there are statistically significant differences between winter and summer average returns and that winter returns are higher than summer returns. It is also important to notice that we got similar conclusions when we repeat the regression analysis with daily returns.

Fourth, we reject the hypothesis that the Halloween effect is explained by the January Effect, moreover we didn't find the January effect present in the European Equity Mutual Funds. An interesting conclusion in this dissertation is that the Halloween effect is not explained by the higher performance during the winter but is the poor performance during the third quarter of the year that explains the anomaly. We found this explanation valid for 114 of the 120 funds in which we identify the presence of the anomaly.

The fifth conclusion came from the analyzes of the investment strategies: the first based on the Halloween effect and the second based on the trivial buy-and-hold strategy. The Halloween strategy outperforms the Buy-and-Hold strategy in 144 funds and the reward-to-risk ratio in 135 funds is bigger for the Halloween strategy than for the Buy-and-Hold strategy. Therefore, the Halloween strategy is an exploitable opportunity.

One important point that we cover in this dissertation is that the Halloween effect became statistically insignificant after the Bouman and Jacobsen (2002) publication, is the market efficiency working? Even that we would like to say yes, the Halloween effect remained economically significant after the start of the Euro crisis in the second half of 2007 so it still represents an exploitable opportunity.

Our findings suggest that the Halloween effect is present in the European Equity Mutual Funds and a strategy based in this anomaly provides higher profits. We also suggest that the negative returns during the summer months, mainly during the third quarter, might be one of the explanations for this calendar effect however further research on this area might be needed.

The Efficient Market Hypothesis has more than one century of history and however no one knows the answer to the question: “Are Stock Markets efficient?”. We have made some developments on the study of the Halloween effect and we have pointed some directions that may lead for the solution of the puzzle.

## References


- Bouman, S. and Jacobsen., 2002. The Halloween Indicator, "Sell in May and Go Away": Another Puzzle, *American Economic Review*, vol. 92, no. 5, pages 1618-1635.

- Carrazedo, T., 2010. The Halloween Effect in European Sectors. *Master Dissertation in Finance*, ISCTE.

- Doeswijk, R.Q., 2008. The Optimism Cycle: Sell in May, *The Economist*, vol. 156, no. 2, pages 175-200.

- Fama, E.F., 1970. Efficient Capital Markets: A Review of Theory and Empirical Work, *The Journal of Finance*, vol. 25, no. 2, pages 383-417.

- Hong, H., Yu, J., 2009. Gone Fishin': Seasonality in Trading Activity and Asset Prices. *Journal of Financial Markets*, vol. 12, no. 4, pages 672-702

- Jacobsen, B. and N. Visaltanachoti, 2009. The Halloween Effect in US Sectors, *The Financial Review*, vol. 44, no. 3,pages 437-459.

- Jacobsen, B. and Marquering, W., 2008. Is it the weather?, *Journal of Banking & Finance*, vol. 32, no.4, pages 526-540.

- Jacobsen, B. and Marquering, W., 2009. Is it the weather? Response, *Journal of Banking & Finance*, vol. 33, no. 3, pages 583-587.

- Jacobsen, B., A. Mamun and N. Visaltanachoti, 2005. Seasonal, Size and Value Anomalies, *Working Paper*, Massey University.

- Jacobsen, B. and Zhang, Y., 2010. Are Monthly Seasonals Real? A Three Century Perspective, *Working Paper*, Massey University.

- Kamstra, M.J., Kramer, L.A., Levi, M.D., 2003. Winter Blues: A SAD stock market cycle, *American Economic Review*, vol. 93, pages 324-343.

- Kelly, P. and F. Meschke, 2010. Sentiment and stock returns: The SAD anomaly revisited, *Journal of Banking and Finance*, vol. 34, no. 6, pages 1308-1326.

- Levi, M., 1985. Are small firms big performers?, *Investment analyst*, vol. 76, pages 21-27.

- Lucey, B. and S. Zhao, 2008. Halloween or January? Yet Another Puzzle, *International Review of Financial Analyst*, vol. 17, no. 5, pages 1055-1069.

- Mayberly, E. and R. Pierce, 2004. Stock Market Efficiency Withstands another Challenge: Solving the “Sell in May/Buy after Halloween” Puzzle, *Econ Journal Watch*, vol 1, no. 1, pages 29-46.

- Moskalenko, E. and P. Reichlin, 2008. “Sell in May and Go Away” on the Russian Stock Market, *Transformation in der Ökonomie*, pages 257-267.

- Newey, W.K. and K.D. West, 1987. A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. *Econometrica*, vol. 55, no. 3, pages 73-708.

- O'Higgins, M. and J. Downs, 1990. Beating the Dow, A High-Return-Low-Risk method investing in Industrial Stocks with as little as $5000. *New York: Harper Collins*.

# Appendix

## Table A1 – Statistical analysis of each mutual fund

We present figures for the median, average and standard deviation of the monthly returns and the estimated values for $\beta$, the coefficient of the Halloween dummy in the equation $r_t = \alpha + \beta D_H + \varepsilon_t$, and the p-value for the hypothesis test $\beta = 0$.

| ISIN | Name | Median (%) | Average (%) | Std. Dev. (%) | β estimation | p-values Halloween dummy |
|---|---|---|---|---|---|---|
| LU0052265898 | Credit Suisse Equity (Lux) Small&Mid Cap Germany B | 1.04 | 0.20 | 4.21 | 0.0333 | 0.0014 |
| LU0048365026 | Credit Suisse Equity (Lux) Small&Mid Cap Europe B | 1.11 | 0.67 | 7.69 | 0.0292 | 0.0018 |
| FI0008804158 | Danske Invest Eurooppa Osinko K | 0.38 | 0.04 | 6.94 | 0.0259 | 0.0021 |
| LU0086854873 | KBL Key Fund-European Small Companies | 1.39 | 0.59 | 7.93 | 0.0267 | 0.0022 |
| AT0000949342 | BAWAG PSK Europa Stock A | 1.04 | 0.83 | 6.53 | 0.0262 | 0.0028 |
| FR0010177998 | Edmond de Rothschild Europe Midcaps A | 1.10 | 0.53 | 7.10 | 0.0268 | 0.0028 |
| FR0000437576 | Palatine France Mid Cap | 0.65 | 0.10 | 5.05 | 0.0242 | 0.0029 |
| FI0008800065 | Nordea Pohjoismaat Kasvu | 0.46 | 0.38 | 1.15 | 0.0281 | 0.0044 |
| FR0000299356 | Norden | 0.92 | 0.38 | 5.49 | 0.0248 | 0.0045 |
| FR0010077172 | BNP Paribas Midcap Europe P | 0.27 | 0.25 | 2.07 | 0.0203 | 0.0046 |
| LU0130732364 | Pictet-Small Cap Europe-P EUR | 0.15 | 0.12 | 0.36 | 0.0249 | 0.0049 |
| LU0066794719 | PARVEST Equity Europe Mid Cap C C EUR | 1.07 | 0.67 | 4.90 | 0.0194 | 0.0059 |
| FR0000285710 | OFI Palmares Actions Europe I | 0.90 | 0.18 | 5.44 | 0.0186 | 0.0060 |
| FR0007475959 | Generali Audace Europe | 1.00 | 0.35 | 4.21 | 0.0198 | 0.0062 |
| FR0000170060 | Amundi Midcap Euro P | 1.29 | 0.31 | 5.14 | 0.0238 | 0.0067 |
| IT0000388162 | Anima Geo Europa PMI A | 0.96 | 0.59 | 5.02 | 0.0185 | 0.0067 |
| PTYIVOLM0002 | Caixagest PPA | 0.39 | 0.05 | 1.52 | 0.0227 | 0.0071 |
| AT0000918297 | Meinl Core Europe A | 1.02 | 0.30 | 4.26 | 0.0222 | 0.0072 |
| PTYCXNLP0004 | Caixagest Accoes Portugal | 1.06 | 0.25 | 4.01 | 0.0228 | 0.0073 |
| GB0000189281 | Allied Dunbar Europe | 1.25 | 0.58 | 5.43 | 0.0194 | 0.0073 |
| FR0010660142 | Natixis Convertibles Euro R | 1.15 | 0.23 | 6.79 | 0.0087 | 0.0078 |
| LU0106236937 | SCHRODER INTL EURPN L/C-AAC | 0.84 | 0.30 | 4.90 | 0.0186 | 0.0083 |
| FR0000003188 | Natixis Strategie Min Variance Europe | 0.08 | 0.02 | 1.04 | 0.0184 | 0.0089 |
| FR0000437741 | Fructi France Small et Midcap C | 0.12 | 0.13 | 0.18 | 0.0242 | 0.0093 |
| CH0005177073 | BCGE Synchrony Europe Equity A | 1.16 | 0.23 | 5.10 | 0.0178 | 0.0098 |
| IT0001055059 | Azimut Trend Europa | 0.96 | 0.14 | 5.05 | 0.0165 | 0.0099 |
| LU0035880763 | UBP Intl Portfolio Euro Equity | 0.67 | 0.00 | 4.57 | 0.0182 | 0.0101 |
| PTYSAFLM0006 | Santander Accoes Portugal | 0.75 | 0.41 | 6.26 | 0.0217 | 0.0103 |
| AT0000856042 | Pioneer Funds Austria - Select Europe Stock A | 0.39 | 0.30 | 0.77 | 0.0182 | 0.0106 |
| FR0010505578 | Edmond de Rothschild Euro SRI A | 1.10 | 0.56 | 6.26 | 0.0206 | 0.0109 |
| PTYSALLM0008 | Santander PPA | 0.46 | 0.35 | 1.03 | 0.0222 | 0.0110 |
| FR0000170243 | AXA Europe Actions C | 0.28 | 0.25 | 0.41 | 0.0169 | 0.0128 |
| FR0000939860 | Covea Multi Immobilier A | 1.05 | 0.46 | 5.93 | 0.0163 | 0.0128 |
| FR0000029837 | Groupama Croissance I | 1.18 | 0.37 | 5.04 | 0.0188 | 0.0129 |
| IT0000386869 | Pioneer Azionario Europa A | 1.22 | 0.38 | 5.49 | 0.0138 | 0.0134 |
| PTYMESLM0003 | Millennium PPA | 1.19 | 0.23 | 5.90 | 0.0207 | 0.0135 |
| ES0114673033 | Bestinfond FI | 1.07 | 0.22 | 5.22 | 0.0150 | 0.0137 |

| ISIN | Name | Median (%) | Average (%) | Std. Dev. (%) | β estim ation | p-values Halloween dummy |
|---|---|---|---|---|---|---|
| FR0000441685 | Covea Actions Europe Opportunites A | 0.18 | 0.20 | 0.14 | 0.0195 | 0.0143 |
| LU0089640097 | JPM Euroland Equity A Dis EUR | 1.02 | 0.53 | 6.06 | 0.0261 | 0.0149 |
| ES0113319034 | GVC Gaesco Small Caps A, FI | 1.11 | 0.43 | 5.80 | 0.0190 | 0.0165 |
| FR0007456488 | UFF Croissance PME D | 1.13 | -0.65 | 13.82 | 0.0208 | 0.0165 |
| FR0000294613 | Objectif Alpha Europe | 0.25 | 0.26 | 0.43 | 0.0158 | 0.0168 |
| FR0000014292 | Aviva Convertibles A | 0.58 | 0.45 | 1.37 | 0.0072 | 0.0175 |
| FR0000441628 | Covea Actions Europe Hors Euro | 0.31 | 0.22 | 1.09 | 0.0146 | 0.0178 |
| FR0000027104 | SSgA EMU Small Cap Alpha Equity Fund D | 0.00 | -0.08 | 0.98 | 0.0192 | 0.0194 |
| FR0000095200 | Unigestion | 1.25 | 0.16 | 5.23 | 0.0167 | 0.0200 |
| FR0007473798 | Aviva Actions Europe | 0.53 | -0.21 | 5.89 | 0.0160 | 0.0200 |
| PTYPIOLM0000 | BPI Poupanca Accoes PPA | 0.11 | 0.13 | 0.20 | 0.0190 | 0.0201 |
| PTAFIALM0006 | Millennium Accoes Portugal | 0.96 | 0.20 | 7.08 | 0.0190 | 0.0207 |
| LU0048408529 | AXA L European Equities C | 0.18 | 0.19 | 0.15 | 0.0167 | 0.0210 |
| FR0000976292 | Fructifonds Valeurs Europeennes C | 0.95 | 0.28 | 7.09 | 0.0155 | 0.0211 |
| FR0010028910 | BNP Paribas Actions Europe C | 0.96 | 0.29 | 5.80 | 0.0154 | 0.0223 |
| FR0007371703 | Indosuez Valeurs | 0.84 | 0.32 | 5.14 | 0.0154 | 0.0228 |
| FR0000991960 | Oddo Generation Europe ESG A | 0.37 | 0.44 | 3.41 | 0.0173 | 0.0231 |
| IT0000386588 | Allianz Azioni Europa | 0.31 | 0.19 | 1.44 | 0.0133 | 0.0241 |
| LU0012195888 | Danske Invest Nordic A | 0.61 | 0.20 | 3.31 | 0.0214 | 0.0242 |
| FR0000989782 | Groupama France Stock IC | 0.26 | 0.27 | 1.24 | 0.0166 | 0.0252 |
| FR0010259945 | Objectif Actions Euro A | 0.44 | 0.18 | 3.00 | 0.0152 | 0.0254 |
| FR0000008799 | Palatine Mediterranea | 0.91 | 0.07 | 6.72 | 0.0175 | 0.0260 |
| LU0012190491 | Performa Fund - European Equities | 0.22 | 0.13 | 1.51 | 0.0158 | 0.0261 |
| LU0055733355 | Credit Suisse Equity (Lux) Italy B | 1.08 | 0.64 | 5.16 | 0.0194 | 0.0262 |
| FR0000972390 | Candriam Equities F Europe Conviction C | 0.22 | 0.20 | 0.11 | 0.0159 | 0.0262 |
| FR0000437774 | Fructifonds France Actions C | 0.00 | -0.05 | 0.63 | 0.0178 | 0.0272 |
| IT0001050167 | Eurizon Azioni Europa | 0.16 | 0.17 | 0.33 | 0.0142 | 0.0272 |
| FR0007487798 | Surval 21 | 0.44 | 0.11 | 2.19 | 0.0141 | 0.0275 |
| FR0007483474 | Covea Actions Rendement | 0.82 | 0.26 | 3.66 | 0.0163 | 0.0286 |
| FR0010101972 | Atout Europe C | 1.38 | 0.65 | 7.52 | 0.0149 | 0.0293 |
| AT0000856521 | BAWAG PSK Europa Blue Chip Stock A | 0.69 | 0.17 | 5.67 | 0.0153 | 0.0300 |
| FR0000437162 | CM-CIC Europe | 0.20 | 0.14 | 1.34 | 0.0149 | 0.0303 |
| LU0130731986 | Pictet-European Equity Selection-P EUR | 0.67 | 0.17 | 4.52 | 0.0156 | 0.0309 |
| IT0000384385 | Euromobiliare Europe Equity Fund | 0.83 | 0.17 | 6.31 | 0.0126 | 0.0319 |
| ES0170738035 | Foncaixa Bolsa Gestion Euro Estandar, FI | 0.38 | 0.19 | 3.09 | 0.0170 | 0.0323 |
| IT0001033486 | Arca Azioni Europa | 0.29 | 0.02 | 1.41 | 0.0121 | 0.0342 |
| FR0010176487 | Edmond de Rothschild Euro Leaders C | 1.07 | 0.44 | 5.70 | 0.0160 | 0.0345 |
| FR0000029563 | Fructifrance Euro C | 1.14 | 0.68 | 4.69 | 0.0177 | 0.0349 |
| PTYCXHLP0002 | Caixagest Accoes Europa | 1.08 | 1.09 | 14.43 | 0.0154 | 0.0349 |
| LU0072783730 | DZ Int Portfolio - Zuwachs | 1.32 | 0.47 | 5.46 | 0.0142 | 0.0352 |
| BE0058178758 | Petercam Equities Europe A | 0.59 | 0.13 | 3.68 | 0.0160 | 0.0358 |
| FR0007486709 | UFF Grande Europe 0-100 D | 1.39 | 0.63 | 5.88 | 0.0160 | 0.0366 |
| IT0001076626 | Consultinvest Azione | 0.01 | 0.23 | 1.95 | 0.0170 | 0.0366 |
| FR0010135871 | Invesco Actions Euro E | 1.27 | 0.51 | 6.45 | 0.0173 | 0.0377 |
| FR0010619916 | CPR Active Europe - P | 0.90 | 0.23 | 4.08 | 0.0170 | 0.0389 |

| ISIN | Name | Median (%) | Average (%) | Std. Dev. (%) | β estimation | p-values Halloween dummy |
|---|---|---|---|---|---|---|
| LU0062210413 | Dexia Luxpart C Dis | 1.19 | 0.35 | 5.68 | 0.0167 | 0.0408 |
| FR0010784835 | R Conviction Europe C | 0.23 | 1.14 | 13.17 | 0.0150 | 0.0414 |
| FR0000401168 | Stock Picking France | 0.17 | 0.17 | 0.11 | 0.0089 | 0.0419 |
| BE0126161612 | KBC Equity Europe Cap | 0.47 | 0.35 | 5.88 | 0.0146 | 0.0421 |
| PTYESGLM0001 | Espirito Santo Accoes Europa | 0.80 | 0.77 | 6.14 | 0.0125 | 0.0423 |
| PTYPIQLM0008 | BPI Reforma Investimento PPR | 0.24 | 0.07 | 0.87 | 0.0037 | 0.0429 |
| FR0000425027 | Covea Actions Europe D | 0.30 | 0.20 | 1.15 | 0.0146 | 0.0443 |
| ES0138792033 | Foncaixa Bolsa Euro, FI | 0.39 | 0.18 | 2.05 | 0.0163 | 0.0443 |
| PTYPIALM0006 | BPI Europa | 0.60 | 0.20 | 3.17 | 0.0146 | 0.0451 |
| FR0000439226 | HSBC Actions France C | 1.05 | 0.25 | 4.13 | 0.0162 | 0.0454 |
| FR0000437113 | HSBC Actions Developpement Durable A | 1.32 | 0.29 | 5.08 | 0.0161 | 0.0459 |
| LU0043962355 | BNP Paribas L1 Equity Netherlands C C | 1.00 | 0.34 | 4.59 | 0.0168 | 0.0460 |
| FR0010249672 | CD France Expertise | 0.49 | 0.30 | 6.07 | 0.0140 | 0.0461 |
| IT0001053138 | Gestnord Azioni Europa A | 0.68 | 0.32 | 2.39 | 0.0115 | 0.0467 |
| LU0038775747 | Willerequity Europe | 0.47 | 0.36 | 3.29 | 0.0126 | 0.0474 |
| FR0000295230 | Renaissance Europe C | 1.03 | 0.36 | 5.20 | 0.0099 | 0.0503 |
| ES0138840030 | Bankia Dividendo Europa, FI | 0.26 | 0.17 | 0.56 | 0.0140 | 0.0512 |
| FR0000994378 | Federal Conviction ISR EURO P | 0.30 | 0.28 | 1.31 | 0.0154 | 0.0513 |
| FR0000170326 | AXA Europe Opportunites D | 0.99 | 0.19 | 5.00 | 0.0151 | 0.0531 |
| FR0007441795 | Camgestion Valeurs Euro N | 0.35 | 0.29 | 1.09 | 0.0154 | 0.0554 |
| FR0000447609 | Federal Conviction ISR France P | 0.68 | 0.42 | 5.97 | 0.0146 | 0.0573 |
| FR0000286320 | LBPAM Actions Euro R | 0.20 | 0.06 | 1.08 | 0.0148 | 0.0595 |
| LU0121217920 | ING (L) PATRIMONIAL EURO-XC | 0.72 | 0.12 | 2.90 | 0.0080 | 0.0619 |
| FR0010026310 | Foncier Investissement D | 0.79 | 0.42 | 5.84 | 0.0120 | 0.0634 |
| LI0013255646 | LLB Aktien Europa (EUR) | 1.18 | 0.30 | 5.77 | 0.0130 | 0.0648 |
| FR0010106880 | Atout Euroland | 0.45 | 0.53 | 6.00 | 0.0143 | 0.0653 |
| IE0002294183 | Coutts Equator Contl European Eqty Indx Prgm Srs 1 | 0.96 | 0.65 | 6.27 | 0.0138 | 0.0724 |
| AD000A1KBUH4 | Mora Europe Equity Fund A, FI | 0.71 | 0.47 | 3.95 | 0.0136 | 0.0786 |
| FR0000939852 | Covea Multi Europe A | 0.23 | 0.22 | 0.10 | 0.0354 | 0.0800 |
| FR0000016164 | Strategie Indice Europe | 0.86 | 0.26 | 4.62 | 0.0139 | 0.0838 |
| PTYPIILM0008 | BPI Euro Grandes Capitalizacoes | 0.21 | 0.08 | 0.60 | 0.0120 | 0.0867 |
| IT0001029864 | Pioneer Azionario Valore Europa a distribuzione A | 0.18 | 0.17 | 0.17 | 0.0106 | 0.0939 |
| IT0000388535 | AcomeA Europa A1 | 1.21 | 0.36 | 4.83 | 0.0106 | 0.0991 |
| BE0161746475 | Delta Lloyd Institutional European Equities | 0.70 | 0.19 | 4.51 | 0.0119 | 0.0991 |
| FR0000291411 | Objectif Actifs Reels D | 1.48 | 0.30 | 5.18 | 0.0102 | 0.1082 |
| FR0000018954 | LCL Actions Euro D | 1.10 | 0.25 | 6.01 | 0.0120 | 0.1157 |
| NL0009864495 | HOF Hoorneman European Value Fund | 1.18 | 0.64 | 4.72 | 0.0147 | 0.1246 |
| FR0010164558 | Fructi Euro Value | 0.48 | 0.36 | 1.22 | 0.0118 | 0.1302 |
| LU0823427611 | PARVEST EQUITY GERMANY-CC | 0.92 | 0.30 | 4.58 | 0.0173 | 0.1306 |
| ES0114063037 | Santander Acciones Euro FI | 0.22 | 1.16 | 13.21 | 0.0127 | 0.1396 |
| ES0107492037 | Selectiva Europa, FI | 0.21 | 0.31 | 7.19 | 0.0113 | 0.1629 |
| ES0114913033 | Privat Bolsa Europea, FI | 0.84 | 0.14 | 4.81 | 0.0082 | 0.1895 |
| AT0000856695 | Apollo European Equity A | 0.97 | 0.11 | 6.90 | 0.0106 | 0.2004 |
| FR0007437090 | UFF Avenir Euro-Valeur | 0.23 | 0.23 | 0.23 | 0.0082 | 0.2583 |
| LU0082927103 | Santander European Dividend A | 1.27 | 0.60 | 4.55 | 0.0072 | 0.2591 |

| **ISIN** | **Name** | **Median (%)** | **Average (%)** | **Std. Dev. (%)** | **β estim ation** | **p-values Halloween dummy** |
|---|---|---|---|---|---|---|
| AT0000856950 | NOUVELLE EUROPE II | 0.67 | 0.00 | 4.57 | 0.0071 | 0.2703 |
| ES0175605031 | Fon Fineco Ahorro, FI | 0.31 | 0.19 | 1.44 | 0.0020 | 0.3172 |
| FR0007000427 | CCR Arbitrage Volatilite 150 R | 0.22 | 1.16 | 13.21 | 0.0184 | 0.3204 |
| LU0113304017 | ING (L) Invest European Equity X Cap EUR | 0.06 | -0.17 | 1.45 | -0.0019 | 0.3554 |
| NL0000291086 | RZL Euro Aandelenfonds | 0.37 | 0.44 | 3.41 | 0.0044 | 0.3560 |
| FR0000945503 | Allianz Foncier | 1.13 | 0.62 | 4.55 | 0.0052 | 0.4180 |
| ES0138783032 | Fon Fineco I, FI | 0.61 | 0.20 | 3.31 | 0.0033 | 0.4737 |
| FR0000977753 | Croisette Valeurs C | 0.47 | 0.36 | 3.29 | 0.0032 | 0.4897 |
| ES0178520039 | Fondmapfre Dividendo, FI | 0.38 | 0.19 | 3.09 | 0.0026 | 0.5475 |
| PTYMGCLM0009 | Montepio Accoes | 0.20 | 0.06 | 1.08 | -0.0009 | 0.5602 |
| FR0000448979 | MAM Humanis D | 1.13 | 0.52 | 4.14 | 0.0025 | 0.6714 |
| FR0010345793 | CNP Assur-Valeurs A | 1.13 | -0.65 | 13.82 | -0.0060 | 0.7589 |
| SI0021400310 | KD Rastko Equity | 0.89 | 0.74 | 4.76 | -0.0018 | 0.7887 |
| FR0011570613 | ING (L) RENTA-WORLD-XC€ | 0.04 | 0.23 | 1.80 | -0.0003 | 0.9061 |

## Table A2 – Statistical results of the Buy and Hold and Halloween strategies

| ISIN | Name | Buy and Hold Strategy | | | Halloween Strategy | | |
|---|---|---|---|---|---|---|---|
| | | Ann. Return (%) | Std. Dev. (%) | Reward-to-Risk Ratio (%) | Ann. Return (%) | Std. Dev. (%) | Reward-to-Risk Ratio (%) |
| LU0052265898 | Credit Suisse Equity (Lux) Small&Mid Cap Germ B | 4.6 | 26.5 | 17.6 | 7.7 | 16.5 | 46.6 |
| LU0048365026 | Credit Suisse Equity (Lux) Small&Mid Cap Europe B | 3.5 | 25.3 | 13.7 | 6.9 | 16.5 | 41.5 |
| FI0008804158 | Danske Invest Eurooppa Osinko K | 3.4 | 19.0 | 18.0 | 6.5 | 12.2 | 53.3 |
| LU0086854873 | KBL Key Fund-European Small Companies | 3.4 | 22.3 | 15.1 | 6.7 | 15.2 | 43.9 |
| AT0000949342 | BAWAG PSK Europa Stock A | 0.4 | 21.2 | 1.7 | 5.6 | 14.3 | 39.2 |
| FR0010177998 | Edmond de Rothschild Europe Midcaps A | 4.0 | 21.5 | 18.8 | 6.9 | 14.8 | 46.6 |
| FR0000437576 | Palatine France Mid Cap | 4.4 | 20.0 | 21.7 | 6.6 | 13.1 | 50.2 |
| FI0008800065 | Nordea Pohjoismaat Kasvu | 4.1 | 22.8 | 17.7 | 7.0 | 15.3 | 45.7 |
| FR0000299356 | Norden | 4.5 | 20.3 | 22.0 | 6.9 | 13.9 | 49.3 |
| FR0010077172 | BNP Paribas Midcap Europe P | 4.8 | 17.0 | 28.0 | 6.4 | 11.5 | 55.8 |
| LU0130732364 | Pictet-Small Cap Europe-P EUR | 5.5 | 22.9 | 24.0 | 7.1 | 15.9 | 44.9 |
| LU0066794719 | PARVEST Equity Europe Mid Cap C C EUR | 4.7 | 16.7 | 28.3 | 6.3 | 11.2 | 56.4 |
| FR0000285710 | OFI Palmares Actions Europe I | 4.4 | 15.6 | 28.2 | 6.0 | 10.4 | 57.8 |
| FR0007475959 | Generali Audace Europe | 3.7 | 16.5 | 22.3 | 5.9 | 10.8 | 54.7 |
| FR0000170060 | Amundi Midcap Euro P | 4.6 | 21.7 | 21.1 | 6.7 | 14.4 | 46.7 |
| IT0000388162 | Anima Geo Europa PMI A | 4.9 | 16.2 | 30.3 | 6.2 | 10.3 | 60.5 |
| PTYIVOLM0002 | Caixagest PPA | 1.9 | 20.7 | 9.1 | 5.6 | 13.0 | 43.2 |
| AT0000918297 | Meinl Core Europe A | 3.5 | 18.4 | 19.1 | 6.1 | 10.4 | 59.0 |
| PTYCXNLP0004 | Caixagest Accoes Portugal | 1.6 | 20.6 | 7.8 | 5.4 | 13.2 | 41.4 |
| GB0000189281 | Allied Dunbar Europe | 4.4 | 15.6 | 28.3 | 6.1 | 10.8 | 56.4 |
| FR0010660142 | Natixis Convertibles Euro R | 3.3 | 7.7 | 43.3 | 4.4 | 5.2 | 83.8 |
| LU0106236937 | SCHRODER INTL EURPN L/C-AAC | 3.2 | 15.3 | 21.0 | 5.6 | 9.1 | 61.2 |
| FR0000003188 | Natixis Strategie Min Variance Europe | 2.8 | 15.2 | 18.2 | 5.4 | 9.9 | 53.8 |
| FR0000437741 | Fructi France Small et Midcap C | 4.0 | 20.8 | 19.2 | 6.6 | 12.0 | 55.1 |
| CH0005177073 | BCGE Synchrony Europe Equity A | 3.0 | 14.8 | 20.3 | 5.4 | 9.0 | 60.1 |
| IT0001055059 | Azimut Trend Europa | 2.7 | 13.8 | 19.7 | 5.2 | 9.3 | 55.2 |
| LU0035880763 | UBP Intl Portfolio Euro Equity | 2.2 | 15.3 | 14.6 | 5.2 | 8.2 | 63.8 |
| PTYSAFLM0006 | Santander Accoes Portugal | 3.6 | 19.9 | 18.2 | 6.0 | 12.7 | 46.9 |
| AT0000856042 | Pioneer Funds Austria - Select Europe Stock A | 1.5 | 15.1 | 10.2 | 4.9 | 8.6 | 57.4 |
| FR0010505578 | Edmond de Rothschild Euro SRI A | 3.7 | 18.1 | 20.3 | 6.0 | 11.4 | 52.6 |
| PTYSALLM0008 | Santander PPA | 4.3 | 21.2 | 20.4 | 6.2 | 14.5 | 43.0 |
| FR0000170243 | AXA Europe Actions C | 3.4 | 14.6 | 23.0 | 5.4 | 9.1 | 59.2 |
| FR0000939860 | Covea Multi Immobilier A | 5.1 | 15.5 | 33.1 | 6.1 | 7.7 | 78.8 |
| FR0000029837 | Groupama Croissance I | 4.3 | 16.5 | 25.9 | 6.0 | 11.4 | 52.4 |
| IT0000386869 | Pioneer Azionario Europa A | 1.8 | 12.1 | 14.7 | 4.4 | 8.2 | 53.5 |
| PTYMESLM0003 | Millennium PPA | 3.8 | 19.9 | 18.9 | 5.9 | 13.5 | 44.1 |
| ES0114673033 | Bestinfond FI | 7.3 | 13.8 | 52.8 | 6.9 | 9.1 | 75.8 |
| FR0000441685 | Covea Actions Europe Opportunites A | 3.5 | 16.9 | 20.7 | 5.8 | 9.1 | 64.0 |
| LU0089640097 | JPM Euroland Equity A Dis EUR | 4.9 | 22.5 | 21.6 | 7.0 | 17.2 | 41.0 |
| LU0010012721 | BNP Paribas L1 Equity Europe C C | 2.7 | 15.1 | 18.1 | 5.1 | 8.8 | 57.9 |
| PTYPIGLM0000 | BPI Portugal | 2.8 | 18.5 | 15.1 | 5.5 | 12.4 | 44.2 |

| ISIN | Name | Buy and Hold Strategy | | | Halloween Strategy | | |
|---|---|---|---|---|---|---|---|
| | | Ann. Return (%) | Std. Dev. (%) | Reward-to-Risk Ratio (%) | Ann. Return (%) | Std. Dev. (%) | Reward-to-Risk Ratio (%) |
| IT0001050225 | Eurizon Azioni Area Euro | 5.4 | 19.7 | 27.2 | 6.6 | 15.6 | 42.3 |
| ES0113319034 | GVC Gaesco Small Caps A, FI | 1.3 | 19.7 | 6.6 | 5.1 | 9.4 | 54.3 |
| FR0007456488 | UFF Croissance PME D | 2.0 | 19.5 | 10.4 | 5.5 | 12.3 | 44.9 |
| FR0000294613 | Objectif Alpha Europe | 3.0 | 14.3 | 20.9 | 5.1 | 8.9 | 57.8 |
| FR0000014292 | Aviva Convertibles A | 3.8 | 7.4 | 52.1 | 4.3 | 4.4 | 96.5 |
| FR0000441628 | Covea Actions Europe Hors Euro | 1.9 | 13.9 | 13.7 | 4.6 | 9.4 | 49.3 |
| FR0000027104 | SSgA EMU Small Cap Alpha Equity Fund D | 4.8 | 19.0 | 25.0 | 6.3 | 12.1 | 52.0 |
| FR0000095200 | Unigestion | 1.3 | 15.8 | 8.5 | 4.8 | 9.6 | 50.1 |
| FR0007473798 | Aviva Actions Europe | 3.4 | 14.5 | 23.4 | 5.3 | 8.6 | 61.7 |
| PTYPIOLM0000 | BPI Poupanca Accoes PPA | 2.9 | 18.4 | 15.7 | 5.4 | 12.3 | 43.8 |
| PTAFIALM0006 | Millennium Accoes Portugal | 2.4 | 19.0 | 12.8 | 5.3 | 12.0 | 44.0 |
| LU0048408529 | AXA L European Equities C | 2.2 | 16.5 | 13.3 | 5.0 | 9.8 | 50.6 |
| FR0000976292 | Fructifonds Valeurs Europeennes C | 2.9 | 15.2 | 19.3 | 5.1 | 9.4 | 54.1 |
| FR0010028910 | BNP Paribas Actions Europe C | 2.8 | 14.7 | 19.1 | 5.0 | 9.8 | 51.1 |
| FR0007371703 | Indosuez Valeurs | 1.4 | 14.3 | 9.8 | 4.6 | 8.5 | 53.5 |
| FR0000991960 | Oddo Generation Europe ESG A | 1.8 | 16.2 | 11.2 | 4.9 | 9.2 | 53.4 |
| IT0000386588 | Allianz Azioni Europa | 2.8 | 12.8 | 22.3 | 4.8 | 7.9 | 59.9 |
| LU0012195888 | Danske Invest Nordic A | 4.3 | 19.1 | 22.4 | 6.4 | 12.1 | 52.6 |
| FR0000989782 | Groupama France Stock IC | 4.2 | 14.9 | 28.5 | 5.8 | 8.9 | 65.0 |
| FR0010259945 | Objectif Actions Euro A | 3.4 | 14.1 | 23.9 | 5.2 | 8.4 | 62.4 |
| FR0000008799 | Palatine Mediterranea | 3.2 | 15.9 | 20.3 | 5.5 | 10.2 | 54.1 |
| LU0012190491 | Performa Fund - European Equities | 4.2 | 15.6 | 27.1 | 5.6 | 9.6 | 58.3 |
| LU0055733355 | Credit Suisse Equity (Lux) Italy B | 3.3 | 17.2 | 19.0 | 5.7 | 10.6 | 53.8 |
| FR0000972390 | Candriam Equities F Europe Conviction C | 3.1 | 15.8 | 19.8 | 5.2 | 9.9 | 52.9 |
| FR0000437774 | Fructifonds France Actions C | 3.6 | 16.6 | 21.6 | 5.7 | 9.6 | 59.2 |
| IT0001050167 | Eurizon Azioni Europa | 2.0 | 14.1 | 14.5 | 4.6 | 9.7 | 47.4 |
| FR0007487798 | Surval 21 | 3.2 | 13.9 | 22.8 | 5.1 | 9.5 | 53.6 |
| FR0007483474 | Covea Actions Rendement | 3.7 | 15.5 | 23.6 | 5.4 | 9.7 | 56.1 |
| FR0010101972 | Atout Europe C | 2.3 | 15.0 | 15.2 | 4.7 | 9.7 | 48.5 |
| AT0000856521 | BAWAG PSK Europa Blue Chip Stock A | 0.7 | 14.5 | 4.5 | 4.3 | 9.3 | 45.9 |
| FR0000437162 | CM-CIC Europe | 2.6 | 14.7 | 17.4 | 4.9 | 9.5 | 51.6 |
| LU0130731986 | Pictet-European Equity Selection-P EUR | 2.3 | 15.9 | 14.6 | 4.9 | 9.8 | 50.0 |
| IT0000384385 | Euromobiliare Europe Equity Fund | 1.5 | 12.7 | 11.5 | 4.1 | 8.4 | 48.7 |
| ES0170738035 | Foncaixa Bolsa Gestion Euro Estandar, FI | 2.7 | 16.5 | 16.3 | 5.2 | 10.1 | 51.0 |
| IT0001033486 | Arca Azioni Europa | 1.9 | 12.2 | 15.3 | 4.2 | 7.8 | 53.7 |
| FR0010176487 | Edmond de Rothschild Euro Leaders C | 4.7 | 14.7 | 31.8 | 5.9 | 9.1 | 64.5 |
| FR0000029563 | Fructifrance Euro C | 2.8 | 17.2 | 16.5 | 5.4 | 9.5 | 56.2 |
| PTYCXHLP0002 | Caixagest Accoes Europa | 1.1 | 15.5 | 7.3 | 4.5 | 9.2 | 48.8 |
| LU0072783730 | DZ Int Portfolio - Zuwachs | 0.9 | 14.9 | 6.3 | 4.2 | 8.5 | 49.9 |
| BE0058178758 | Petercam Equities Europe A | 3.6 | 16.7 | 21.8 | 5.4 | 10.9 | 49.4 |
| FR0007486709 | UFF Grande Europe 0-100 D | 1.7 | 16.2 | 10.6 | 4.8 | 11.9 | 40.6 |
| IT0001076626 | Consultinvest Azione | 2.7 | 16.7 | 16.4 | 5.3 | 10.5 | 50.8 |
| FR0010135871 | Invesco Actions Euro E | 4.4 | 19.5 | 22.7 | 5.9 | 14.4 | 40.6 |
| FR0010619916 | CPR Active Europe - P | 1.8 | 18.3 | 9.6 | 4.9 | 12.2 | 40.3 |
| LU0062210413 | Dexia Luxpart C Dis | -0.2 | 17.6 | -1.4 | 4.3 | 8.7 | 49.5 |

| ISIN | Name | Buy and Hold Strategy | | | Halloween Strategy | | |
|---|---|---|---|---|---|---|---|
| | | Ann. Return (%) | Std. Dev. (%) | Reward-to-Risk Ratio (%) | Ann. Return (%) | Std. Dev. (%) | Reward-to-Risk Ratio (%) |
| FR0010784835 | R Conviction Europe C | 2.6 | 14.5 | 18.0 | 4.9 | 7.9 | 61.4 |
| BE0126161612 | KBC Equity Europe Cap | 2.5 | 15.7 | 15.7 | 4.8 | 9.6 | 50.0 |
| PTYESGLM0001 | Espirito Santo Accoes Europa | 2.5 | 12.5 | 19.8 | 4.4 | 6.5 | 67.8 |
| PTYPIQLM0008 | BPI Reforma Investimento PPR | 2.5 | 4.2 | 59.9 | 3.1 | 3.1 | 100.8 |
| FR0000425027 | Covea Actions Europe D | 2.2 | 14.8 | 14.7 | 4.7 | 8.4 | 56.6 |
| ES0138792033 | Foncaixa Bolsa Euro, FI | 2.4 | 16.3 | 14.6 | 5.0 | 10.2 | 49.5 |
| PTYPIALM0006 | BPI Europa | 2.7 | 16.3 | 16.7 | 4.8 | 11.2 | 42.9 |
| FR0000439226 | HSBC Actions France C | 3.4 | 16.1 | 21.0 | 5.4 | 10.1 | 52.9 |
| FR0000437113 | HSBC Actions Developpement Durable A | 2.4 | 16.5 | 14.5 | 5.0 | 10.7 | 46.8 |
| LU0043962355 | BNP Paribas L1 Equity Netherlands C C | 1.8 | 18.1 | 9.7 | 4.8 | 9.4 | 51.3 |
| FR0010249672 | CD France Expertise | 2.8 | 14.8 | 18.7 | 4.8 | 9.3 | 51.8 |
| IT0001053138 | Gestnord Azioni Europa A | 1.9 | 12.4 | 15.1 | 4.1 | 7.7 | 52.7 |
| LU0038775747 | Willerequity Europe | -0.3 | 12.6 | -2.4 | 3.6 | 8.3 | 43.7 |
| FR0000295230 | Renaissance Europe C | 4.7 | 10.6 | 44.3 | 5.1 | 7.7 | 66.0 |
| ES0138840030 | Bankia Dividendo Europa, FI | 2.6 | 14.2 | 18.4 | 4.8 | 8.5 | 55.8 |
| FR0000994378 | Federal Conviction ISR EURO P | 2.3 | 16.0 | 14.4 | 4.8 | 8.4 | 57.4 |
| FR0000170326 | AXA Europe Opportunites D | 2.3 | 17.7 | 12.9 | 4.9 | 10.8 | 45.2 |
| FR0007441795 | Camgestion Valeurs Euro N | 3.4 | 16.0 | 21.2 | 5.2 | 9.9 | 52.5 |
| FR0000447609 | Federal Conviction ISR France P | 3.1 | 14.9 | 21.2 | 5.1 | 8.4 | 60.1 |
| FR0000286320 | LBPAM Actions Euro R | 1.9 | 16.4 | 11.5 | 4.6 | 10.0 | 46.5 |
| LU0121217920 | ING (L) PATRIMONIAL EURO-XC | 2.4 | 8.5 | 28.7 | 3.8 | 5.5 | 69.0 |
| FR0010026310 | Foncier Investissement D | 5.1 | 14.3 | 35.7 | 5.5 | 7.6 | 72.9 |
| LI0013255646 | LLB Aktien Europa (EUR) | 2.6 | 15.0 | 17.2 | 4.6 | 8.8 | 52.0 |
| FR0010106880 | Atout Euroland | 0.9 | 16.2 | 5.6 | 4.2 | 9.8 | 43.5 |
| IE0002294183 | Coutts Equator Contl European Eqty Indx Prgm Srs 1 | 3.0 | 14.9 | 20.1 | 4.9 | 9.2 | 52.8 |
| AD000A1KBUH4 | Mora Europe Equity Fund A, FI | 0.0 | 14.9 | 0.1 | 3.8 | 9.0 | 41.7 |
| FR0000939852 | Covea Multi Europe A | 1.2 | 14.6 | 8.2 | 4.7 | 8.2 | 58.2 |
| FR0000016164 | Strategie Indice Europe | 1.6 | 15.5 | 10.1 | 4.4 | 8.7 | 51.1 |
| PTYPIILM0008 | BPI Euro Grandes Capitalizacoes | 1.5 | 13.5 | 11.1 | 4.1 | 8.3 | 49.4 |
| IT0001029864 | Pioneer Azionario Valore Europa a distribuzione A | 1.6 | 13.5 | 11.5 | 4.0 | 9.6 | 41.0 |
| IT0000388535 | AcomeA Europa A1 | 2.4 | 13.8 | 17.5 | 4.1 | 9.2 | 45.3 |
| BE0161746475 | Delta Lloyd Institutional European Equities | 2.7 | 14.9 | 18.3 | 4.5 | 8.4 | 53.9 |
| FR0000291411 | Objectif Actifs Reels D | 4.5 | 13.6 | 32.9 | 5.0 | 7.1 | 69.9 |
| FR0000018954 | LCL Actions Euro D | 1.4 | 16.0 | 9.0 | 4.1 | 9.4 | 43.4 |
| NL0009864495 | HOF Hoorneman European Value Fund | 1.8 | 22.3 | 8.0 | 4.6 | 11.8 | 38.6 |
| FR0010164558 | Fructi Euro Value | 0.3 | 16.6 | 1.7 | 3.6 | 10.0 | 36.3 |
| LU0823427611 | PARVEST EQUITY GERMANY-CC | 1.3 | 22.2 | 6.0 | 4.7 | 17.1 | 27.3 |
| ES0114063037 | Santander Acciones Euro FI | 1.9 | 15.0 | 12.7 | 4.3 | 8.1 | 53.1 |
| ES0107492037 | Selectiva Europa, FI | 1.2 | 15.3 | 8.1 | 4.1 | 9.0 | 45.1 |
| ES0114913033 | Privat Bolsa Europea, FI | 0.2 | 11.8 | 2.0 | 3.1 | 5.8 | 52.9 |
| AT0000856695 | Apollo European Equity A | -4.2 | 16.5 | -25.5 | 2.4 | 8.4 | 29.2 |
| FR0007437090 | UFF Avenir Euro-Valeur | 2.0 | 13.2 | 15.2 | 3.6 | 5.9 | 61.3 |
| LU0082927103 | Santander European Dividend A | 4.7 | 14.4 | 32.6 | 4.7 | 7.3 | 63.8 |
| AT0000856950 | NOUVELLE EUROPE II | -0.5 | 12.4 | -3.8 | 2.6 | 7.7 | 34.1 |
| ES0175605031 | Fon Fineco Ahorro, FI | 1.7 | 3.5 | 49.7 | 2.4 | 1.8 | 128.6 |

| ISIN | Name | Buy and Hold Strategy | | | Halloween Strategy | | |
|---|---|---|---|---|---|---|---|
| | | Ann. Return (%) | Std. Dev. (%) | Reward-to-Risk Ratio (%) | Ann. Return (%) | Std. Dev. (%) | Reward-to-Risk Ratio (%) |
| LU0113304017 | ING (L) Invest European Equity X Cap EUR | -2.6 | 4.8 | -55.2 | -0.3 | 4.7 | -5.7 |
| FR0007000427 | CCR Arbitrage Volatilite 150 R | 7.6 | 33.0 | 23.1 | 7.6 | 32.9 | 23.1 |
| FR0000945503 | Allianz Foncier | 4.9 | 15.2 | 32.1 | 4.5 | 7.9 | 57.3 |
| ES0138783032 | Fon Fineco I, FI | 1.6 | 8.3 | 19.7 | 2.5 | 3.2 | 79.3 |
| FR0000977753 | Croisette Valeurs C | 3.3 | 9.5 | 34.7 | 3.4 | 4.9 | 70.2 |
| ES0178520039 | Fondmapfre Dividendo, FI | 1.8 | 8.4 | 21.9 | 2.6 | 4.4 | 58.9 |
| PTYMGCLM009 | Montepio Accoes | 0.7 | 4.6 | 14.3 | 1.4 | 3.9 | 34.4 |
| FR0000448979 | MAM Humanis D | 4.3 | 11.9 | 36.2 | 3.8 | 5.2 | 72.5 |
| FR0010345793 | CNP Assur-Valeurs A | -5.7 | 32.6 | -17.4 | -12.4 | 31.1 | -40.0 |
| SI0021400310 | KD Rastko Equity | 5.4 | 16.2 | 33.5 | 3.6 | 9.6 | 37.0 |
| FR0011570613 | ING (L) RENTA-WORLD-XC€ | 2.3 | 4.3 | 53.2 | 2.2 | 3.2 | 69.4 |

## Figure A1 – Cumulative returns for the Buy-and-Hold and Halloween strategies